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Alcohol

The Sanction for Its Use

Scientifically Established and Popularly Expounded by a Physiologist

Translated from the German of

Dr. J. Starke

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EPITOME OF THE CHIEF CONCLUSIONS,

FOR FACILITATING REFERENCE AND AS A GUIDE TO THE FOLLOWING TREATISE

MEDICAL

1. *Preliminary.* The alcohol of alcoholic drinks does *not* of itself possess the property of inducing persons to take ever-increasing amounts. Furthermore, it is easy for any healthy person to restrict his use of alcohol within the bounds of moderation. As a rule a person comes to know well enough the amount of alcoholic drinks which is wholesome for him; therefore everybody is perfectly well aware of what is moderate and what is not.

2. *The moderate use of alcohol has nothing to do with drunkenness.* Neither the existence of notorious topers nor the causes that lead men to drunkenness need induce a mod-

erate man to think that he must renounce the reasonable use of alcohol.

The disposition to excessive drinking has its origin in definite peculiarities and circumstances of the individuals affected, who are mentally abnormal or otherwise unfortunate. The necessary predisposition to drunkenness is the almost continual presence of the need of "stupefaction." Where this is lacking, where therefore alcoholic drinks are taken rather for the sake of excitement, as is the case with the mentally healthy, who in general lead a happy existence, the regular use of alcohol *never* induces drunkenness.

3. The moderate use of alcohol has nothing to do with the development of any disease whatever. In particular, it is not correct to apply the medical term "chronic alcoholism" to any other cases than those resulting from the continued and pronounced immoderate use of alcohol. Even if this may lead to the development of diseases—and the intimate connection is often very obscure and the alcohol of the drinks is too uniformly and too exclusively adduced as the cause—the relation of the moderate use of alcohol to the development of any disease whatever is certainly *never* made out.

Consider, on the other hand, the nutritive value of alcoholic drinks. That these, according to their other constituents and to the proportion of alcohol contained in them, may be essentially nutritious, should never be forgotten. In this matter, as in the case of the use of any nutritious fluid, we may avoid danger if we remember (a) that the daily excessive ingestion of any fluid—even water—may burden the heart, the blood-vessels, and the kidneys, and (b) that of any article of food one may take the more if he practises moderation in other matters and takes more exercise daily.

4. The moderate use of alcohol is for many a man of the present day a very important hygienic measure. The specific effects of alcohol—provided, as has before been remarked, they do not lead to the development of disease, which is the case with the moderate use of alcohol—are indeed a useful corrective of the modern lack of muscular activity combined, as is often the case, with an overwrought nervous system and with a sedentary life. Now, of all our articles of food and drink, alcohol is the only one that has the two important properties of abating nervous irritability and of so

influencing the distribution of the blood that the skin becomes rich in that fluid and the internal organs sparingly provided with it.

In these respects its action is quite the opposite of that of the caffeine of coffee and tea, which exalts the excitability of our nervous system and so distributes the blood that the skin is deficient in it, and in consequence the internal organs are gorged.

5. Final result. The fact that the physician often interdicts alcoholic drinks in a few diseases, restricted in number and more or less severe (for example, inflammations of the kidney), does not militate against the moderate use of alcohol by the public, since the same is the case with regard to other articles of food and drink which are generally harmless. We are therefore quite justified in saying: There is nothing in medical experience which speaks against the moderate use of good alcoholic drinks by the public, but much that speaks in favour of it.

PHYSICAL

A. Alcohol normally formed in the living being.

1. Alcohol, up to a certain point, is an old acquaintance of the bodily cells, even of those of persons who from their birth on have lived an " abstinent " life. In order that the living organism should come into contact with alcohol, it is not at all necessary that the latter should be made artifically and then ingested, but the cells of plants, of animals, and also of man already know alcohol, since it is formed in almost every organism when it is not artificially furnished to it. If we seek for the origin of the alcohol thus formed normally in living beings, from plants to man, we do not encounter pathological curiosities, but normal metabolic processes which go on within the cells themselves, and therefore in the very citadel of life.

In plants, the formation of alcohol belongs to the normal respiratory processes of the cells. In animals and man, the question of the part played by the alcohol formed and present is not yet decided.

2. Conclusion. The bodily cells of man are at least not naturally strangers to alcohol and to its elaboration.

B. Alcohol taken in moderate quantities.

1. Alcohol nourishes. The alcohol in-

gested—which affects digestion favourably so far as it affects it at all—is easily and rapidly absorbed from the stomach and incorporated with the juices of the body, and in the latter, except for a little loss, it serves as nutrient material. As such it behaves like the carbohydrates to the extent that it creates heat and furnishes strength for muscular work.

2. In addition, it exerts a specific action on the nervous system. Up to the time that the ingested alcohol performs its part as nutrient material, there is a period during which it circulates in the blood "as yet undecomposed alcohol," and may act "specifically" on the organs. The duration and intensity of this specific action of alcohol depend on the amount ingested and on the needs of the system for nourishment; the smaller the former and the greater the latter—greater with increased muscular activity and with diminished ingestion of other nutriment—the less are the duration and intensity of the "specific effects of alcohol." On the whole, these specific effects of alcohol are exerted on the nervous system, either on the terminal apparatuses of the nerves (see No. 4) or on the central nervous system (see No. 5). The nerve trunks are not essen-

tially affected, neither are the blood-vessels directly. With the latter, as with the heart, the effect is either on the vasomotor nerves or on those of the heart; or else, in the case of the heart, this muscle, like any other, makes use of the alcohol as a nutrient material in the performance of its work, as has been described under No. 1, the " nutritive effects of alcohol." On the whole, therefore, alcohol is a nutrient and a nervine, exerting at the same time a nutritive and a specific action.

3. Alcohol is not the only agent that acts at the same time as a nutrient and also specifically, but the carbohydrates, which are necessary for us (cereals, sugar), act in the same way, even if their specific effects, so far as they have yet been studied, are decidedly weaker than those of alcohol.

4. Alcohol stimulates the terminal apparatuses of the nerves of the bodily organs. It is the same with the nerves of sensation—for example, those of taste and smell—and those of the secretory nerves in the glands. Thus it happens that we smell of alcohol and taste it, and that it is excreted by glands (in the salivary and gastric secretion, etc.). It stimulates many of the glandular nerves through the

medium of the central nervous system, but probably many of them also directly.

5. Alcohol, taken in moderation, does not act as a poison to the central nervous system, for there is lacking every characteristic symptom of such an action.

a. The action consists in functional changes which lie within the range of quite normal play, and not in " disturbances."

b. This continues to be the case even when alcohol is taken regularly for years in succession.

c. No " disturbances " occur if the use of alcohol is suddenly discontinued after it has been kept up for years.

6. The action of the regular moderate use of alcohol upon the central nervous system consists in a certain inner mental stimulation, in stimulation of our peculiar, personal, intimate ego with all its qualities (temperament, feelings, talents, and intellectual aptitudes). The result depends solely on the qualities of the ego stimulated.

This stimulation is necessarily connected with a certain physiological consequence, some reduction of the reflex excitability, and according to the degree of stimulation and the

character of the individual there is also a lessening of the susceptibility to external mental impressions or to certain aspects of the external world, therefore only to certain external impressions.

The reason of the reduction of these impressibilities lies not in any sort of paralysis, but in the fact that the central nervous apparatuses are forced to act in a certain direction by the stimulation of the ego, and in the fact that. in consequence thereof and in consonance with a fundamental physiological law, those organs are no longer susceptible to impressions coming from without.

With all this, the consciousness is quite clear and there is no narcosis. At the same time the respiratory centre is stimulated, as well as the general vasomotor nerve centre, and the latter indeed in the special sense that the cutaneous vessels are dilated and the internal vessels contracted.

Practically expressed: We feel ourselves internally stimulated; this stimulation holds our "nervous irritability," very unpleasant when aroused, within due bounds. It therefore provides for that alternation of perception, feeling, and thought which is not only agreeable,

but sometimes directly necessary to the individual concerned. In this condition we breathe freely and deep, the skin is pleasantly warm, our internal organs are grateful for the freedom from too much blood, digestion is unimpeded, and the heart beats full and strong. All this is powerful stimulation and its consequences.

C. Special points.

1. Drunkenness, which is to be sharply distinguished from stimulation, the latter being an "internal mental exaltation with perfectly clear consciousness," is "an internal mental exaltation with obfuscation of the relations to the external world."

When a man gets drunk, there is, on the one hand, an increase of the stimulation of the intimate personality always caused by alcohol, but, on the other hand, there now begins, as the result of a certain amount of alcohol, the "clouding," therefore paralysis, in the field of the external relations of the mind. Internal stimulation with clouded consciousness forms the picture of the drunken man. If a man keeps on getting drunk, the paralysis of the outer world functions of the brain (of the cerebral organs of perception, etc.) goes on in-

creasing, and the inner mental exaltation becomes more and more incapable of expressing itself.

2. The "drinker" must be sharply distinguished from the moderate consumer of alcohol, not only by the fact that the latter drinks for the sake of stimulation while the former drinks for the sake of oblivion, but also because the one follows the path of excess while the other remains moderate for his whole life, and also because the hard drinker ruins his central nervous system as well as his nerve trunks, and especially his brain, whereas the moderate drinker neither injures nor disturbs them.

Therefore, since we have good reason to look upon alcoholic oblivion, not as a disturbance, but as within the range of normal functional derangements of the brain elements, we can speak with certainty of "alcoholic poisoning" of the brain only with regard to drunkards, and then only in cases of enormous drinking. The moderate drinker, however, has no poisoning of the brain, provided it is only occasionally that he gets "elevated."

3. The moderate use of alcohol does not affect the procreative capacity, the capability of suckling, or the duration of life.

4. Alcohol does not belong to the "poisons." It is rather a substance which, taken in moderation, nourishes and exerts special effects on the nervous system, effects that are not even "disturbances," and therefore not "phenomena of poisoning."

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SCIENTIFIC SANCTION FOR THE USE OF ALCOHOL

INTRODUCTORY

(*The numerals in the text refer to the bibliography at the end of the volume.*)

The publication of a popular treatise on the relations of alcohol to living organisms, especially to man, is in conformity to a need which is every day apparent. But it must be a radical treatise, one that does not ignore any important point, one that is not limited to general declarations and decisions. Furthermore, it must include everything essential and give the reader clearly to understand on what points we can and on what we cannot rest upon positive facts, for much is certain that the people think has not yet been ascertained, and much is uncertain which seems to not a

few to be established fact. The layman should be able to see how many data must be assembled and critically studied before one can give an opinion from a scientific and professional point of view, so that he may acquire for himself a critical standard for judgment concerning all that he sees and hears about alcohol; finally, every thinking man should be able to form proper rules of life for himself if he only knows the facts bearing upon them.

It has been the author's endeavour to furnish the public with such a treatise, and the reader must judge for himself as to whether or not and to what extent the result carries out this purpose. At least he will learn to what general views the knowledge of our time has given rise in the mind of a professional man who is as far removed from a weakness for alcohol as he is from prejudice against it. This state of mind is indispensable to the fulfilling of such a task, since whoever seeks to instruct the public on a given theme must certainly confine himself to facts, and, judging from facts, it is not at all necessary that alcohol, in moderation, should be shunned. Thus much premised, I may specify the various grounds

on which I have thought this treatise necessary for the public.

Reasons for this Publication. In the ordinary progress of science there is necessary from time to time a revision of the views that pass current with regard to a certain subject, though of course only when the subject is one upon which science has a great bearing in the discussions of the day, and that is pre-eminently the case with the subject of alcohol.

In such cases one may set out upon one of two paths: *Either* one may leave science wholly out of account and confine himself to general and personal experience, in which case it is all the same to him what science does and says. With regard to alcohol in particular, this is the course generally adopted by the people, and they do not fare badly in that path, as we shall see farther on. *Or* he may consult science, as the public is lately doing in the case of alcohol. Naturally this is thrust into the discussions of the day, with which the public must concern itself seriously, so that there may be progress instead of stagnation. Therefore the public, too, must revise its views from time to time, to find out how far they are still in accord with the advances of science. For this reason, then,

the public must be instructed in the scientific side of the present prevailing points of view. The time for such a revision seems to me to have arrived, for, as regards alcohol itself, research has constantly been showing a considerable array of new results.

The following, therefore, is principally a revision, at least of the most generally accepted views concerning alcohol, but, it may be said, it is not that alone. It is not only a criticism of the old demonstrations of scientific advances; it is, in addition, a popularly intelligible picture of conditions under the moderate use of alcohol on the basis of modern scientific facts and demonstrations, especially those of physiology.

In all public discussions at the present day it is not the abuse of alcohol that plays the leading part, but its use. To-day the discussion is no longer as to "moderate or immoderate," but as to whether alcohol shall be used or altogether abstained from. Therefore all declarations concerning the use of alcohol have now to be made under new points of view. Consequently we enter upon a field in which it is far more difficult to argue, and for which more extraordinary knowledge is required,

than formerly, when the question was solely as to the abuse of spirituous drinks. If in past centuries very little knowledge was required to discuss the matter, the case is now quite different when the question is: Can a man make moderate use of good alcoholic drinks, or must he not take a drop of alcohol?

The proposition that the moderate use of alcohol is dangerous is so far from demonstration that the great majority of professional men cannot accept it when they call to mind all the data pertaining to it.

How, then, shall the laity be guided? If they often recall that the general experience of mankind has justified the moderate use of alcoholic drinks, they are again led astray by being constantly told with energy and positiveness that that experience is erroneous. Experience as to the nutritive value of beer, for example, long ago found expression in well-known proverbs. We say: "Where the brewer lives the baker has nothing to do," and "beer is liquid bread," sayings that contain a kernel of perfectly undeniable fact. But, in the first place, beer, from the manner of its preparation and from its composition (especially because the nutritive value of its alcohol

is to be added to that of its carbohydrates), is, apart from the part it plays as a beverage, to be reckoned as in the first class of carbohydrate (cereal) nutrients. In the second place, beer is made from a cereal. Thirdly, its nature is such that the true beer drinker takes the greater part of his daily requirement in the way of nourishment with his beer; what he eats in addition consists essentially of fat and albumin (meat). Of course this whole scheme of diet might be continued for decades together without injury to health, even if beer were not in a high degree a substitute for bread and vegetables. In cases personally known to me those subjected to this course of life have lived to be seventy years old or more.

To be sure, in bread one may procure the same quantity of nutritive material cheaper, but the question of price has nothing to do with the matter. It is a man's own private affair whether he will feed himself cheaper or dearer, and it should not be forgotten that in our nourishment it is of very great importance, not only on the score of pleasure, but also on that of health, to accompany the indispensable food with appropriate drinks. Therefore, as is well known, we spread bread with various

good things, and thereby the comparative cost of bread and beer is made very much the same.

All things considered, general experience has quite justified the above—quoted proverbs with regard to the nutritive value of beer, and whoever is guided by them cannot go very far astray. As a matter of fact, the nutritive value of beer is by no means small. A litre of Munich beer contains, in round numbers, 35 grammes of nutritive material in the form of alcohol and 60 grammes of other nutritive matter. That means 95 grammes of nutritious substances in a litre, and in four litres 380 grammes of chemically pure, therefore concentrated, nutrient material.

The matter is simply this: Beer is a beverage containing alcohol; hence the doubt as to so self-evident and undoubted a fact as that there is nutriment in beer. Since alcohol comes somehow into play to-day, there are many who know not what to think. And so the uncertainty of the public on this question is one of the pronounced signs of the times. And if this uncertainty culminates in expressions which induce professional men to keep silence, the reason is none of the worst. The public in general might well be anxious if it were

merely a matter of views and theories, but it is not.

The question is quite the same to-day with regard to alcohol, in the estimation of the public, as it long has been. It amounts to this, that the uncertainty of views entertained by the public has given rise practically to a more or less widespread embittered condition of life. All this necessarily is intimately connected. The uncertainty of convictions—whether one should not take a drop of alcohol or whether one may at least take it in moderate quantities—must always disconcert people anew, since this question is continually coming up, when one is on a journey, at home, or in company, and even when one consults a physician who orders wine; and indeed in religion the question crops out. When the latter instance is manifested, the embitterment of life is at the highest point. And this whole question of alcohol is so imperative for the very reason that its use sends its roots deep into life in all directions.

Here, then, a word of relief is necessary, and all the more for the reason, as the following treatise will show, that there is not the slightest ground for all this uncertainty,

unrest, and bitterness, since neither natural science nor medicine has hitherto shown that the moderate use of good alcoholic drinks is harmful. We may even say the very opposite. This, from the point of view of the public, is one of the reasons for the publication of my book.

Another question, one which the medical part of this book will answer in the negative, is as to whether others than the modern man, with his overwrought nervous system, have not found the moderate use of alcohol necessary. It is a question also if we do not daily take in substances containing a certain amount of alcohol which in time are injurious to health. This question the medical part of this treatise will answer in the affirmative. We shall learn from it of the antagonism between the effects of alcohol and those of caffeine, and find also that the decrease in the use of alcohol goes hand in hand with an increase in the use of caffeine in a way that cannot be without harm to health. And, since doubt as to the nutritive value of alcohol itself is applied also to alcoholic drinks, there are many to-day who think that the latter are simply beverages, occasionally to be regarded as nutrients, but not of

much account in that direction. We have already seen, for example, how thoroughgoing is this misapprehension with regard to beer. It is held also that alcoholic drinks are a luxury, in conformity to the demonstration, about a hundred years old, that beverages are luxuries, although it is one of the primary facts of the physiology of nutrition that we need luxuries quite as much as purely nutritive material.

The error that an alcoholic drink is a beverage and nothing else has to be compensated for—not by the special fact that the drinking of beer by whoever takes its nutritive value into account causes no harm, provided he takes it in moderation. As with beer, though perhaps in a lesser degree, the same is true of other alcoholic drinks. The uncertainty which especially prevails with regard to the nutritive value of alcoholic drinks is by no means equally harmless for all men and for their health, but may produce very untoward results. There will be a further exposition of this matter in the medical part of this work.

Here, since the subject is not the mere consequences of the *abuse* of alcohol, but those of its *use,* these chiefly and almost exclusively, it is

in no wise a question simply of medical experiences concerning the use of alcoholic drinks (not to be further identified with "alcohol"), but above all also of the pharmacologists' and physiologists' special investigations of alcohol as well as of those of the hygienists and physicians who have been trained in physiology. But in order to estimate critically this special investigation of alcohol, which has been carried on from beginning to end by physiological and scientific methods, one would have to go over all the rest of modern physiology, and the scientific part of this book will afford many illustrations of that.

But naturally medical experiences are of value. Apart from the special modern and experimental investigation of alcohol, as I will call it for brevity, an acquaintance with them also is quite necessary. Medical experience must still help to fill lacunæ in the special investigation of alcohol, and it is of the highest value for the reason that it bears not only upon alcohol as a cause of disease, but also upon its employment in the treatment of disease. Therefore in the most natural manner we shall seek for and find our professionals in those circles that are made up, on the one hand, of

physiologists and pharmacologists, who are intimately familiar with medical experiences, and, on the other hand, of physicians (including the hygienists), for they are in the field of modern physiology and pharmacology. So there is another point established, which, however, does not embrace and cover everything.

Neither of the points that interest us is as yet wholly covered by either medical experiences or the special pharmacological and physiological investigation of alcohol. When everything has been collected from these fields, there still remain lacunæ here and there, and so on this account we must bring in the experience of mankind in general and that of individuals. Apart from all the preceding, then, we possess observations and experiences from individual lives and from various peoples and social strata on the action of the use of alcohol and of the different alcoholic drinks, as well as on the effect of abstinence from alcohol upon life.

Let us now sketch the field of knowledge with its various parts, all of which must be brought into accord. It consists of physiology, pharmacology, medicine, and general and personal experience. If now to these we

add the indispensable critical frame of mind and the absolute freedom from prejudice without which impartial observation is impossible, then we have united all the elements that make up the professional, the adept, who not only must know a great deal, but also draw conclusions critically, skeptically, and without prejudice.

PART I

MEDICAL

MEDICAL

THIS whole treatise, the reader will now be aware, turns continually upon the inquiry as to whether anything opposes the moderate use ofgood alcoholic drinks, and as to whether there is anything in favour of such use of them. We shall consider in two separate sections, the medical and the physical, what the man of science has to say about alcohol and its relations to the living organism. Medicine of course always has to refer to natural science, and the latter in turn, as we shall see farther on, must take the experience of physicians into account if it is to supplement their knowledge. What I shall here bring forward will of itself prove that the subject-matter requires such a separation. We will begin with the medical part.

It is well known that the experience of physicians is of twofold significance, showing, on the one hand, that under certain circumstances, especially in its immoderate use, alcohol may

become the cause of morbid conditions of the organism, and, on the other hand, that the same substance may in other pathological conditions of man prove an important sustaining and curative means. Such is the state of the facts, and whoever holds that it involves a contradiction (because on the one side alcohol causes disease and on the other side cures it) deceives himself, for the condition is, in its finality, nothing but a confirmation, a reflection, from the medical field, of the common experience of mankind. In this matter it is with alcohol as with all other nutritive substances (concerning which more will be said in the scientific part); for example, though albumin is an indispensable article of food, the constant immoderate consumption of albumin may cause sickness.

It is with the physician as with everybody else. The drunkard has been known for many hundreds of years, but his existence has never had much effect on the moderate use of alcohol. Quite as little has the knowledge of "chronic alcoholism" (the continued immoderate use of alcohol), with its potential and to a great degree actual relations to the diseases of man, restrained scientific medicine in

the use of the substance in the most various ways in the treatment of sick persons. And this is not limited to the employment of drugs dissolved in alcohol (such as alcoholic tinctures) or of drugs combined with alcoholic drinks (such as wine of pepsin, ferruginous liqueurs, etc.), but includes also the direct use of alcohol as such for strengthening and curative purposes. We may, therefore, always in accordance with facts, say that the assumed useful, strengthening action of alcoholic drinks in ordinary life is borne out by their observed effects in sickness, moderation, of course, being always observed.

I

THREE PRELIMINARY PROPOSITIONS

Before I enter upon medical questions proper, I must settle a few points of a general nature, because I have observed that in regard to them the public does not seem to be in unison, and because the reader must clearly distinguish them if he is to understand the medical part that is to come. I have heard the idea expressed that moderation in the use of alcoholic drinks (by which, as I have already said, one should always be governed) is very difficult to maintain, with its regulating influence on what we do and on what we leave undone. "For," it is frequently said, "it is the very insidiousness of alcoholic drinks that of itself leads a man to take larger and larger quantities. Moreover, it must evidently be very difficult to return to moderation when it has once been exceeded, and it is far from easy to distinguish between what is moderate and

what is immoderate." If one listens to the public, it will not be long before one or another of these views comes to his ears; and it is to be wondered at, because anybody can readily see that all three of them are groundless. We are all familiar with the "leading to constantly increasing quantities." If it were correct, all those who use alcohol must end in drunkenness. Of course nothing of the sort is the case.

So clear and so important is the obvious conclusion that alcoholic drinks have not the property of alluring man to ever increasing consumption. Where the latter seems to be the case, there is something pertaining to the man himself, something within him or in his circumstances, that rules the unfortunate and leads him to use alcohol as a means to an end.

Quite as untrue is the second statement, that it is particularly hard to return to moderation in the use of alcoholic drinks or, if necessary, to renounce them altogether. The latter applies only to the few who, having been notorious drunkards for years, suddenly have to give up alcohol. But here, too, the views of professional men on the aforesaid difficulties are quite various. But it is always easy in it-

self to limit one's use of alcoholic drinks, and there are numerous proofs of this. First, there are those who are abstainers; as a rule they have formerly been at least moderate drinkers. The next proof is to be found in the observation of physicians that, except with the notorious drinker, abstinence from alcohol is always easily practised whenever it is necessary.

I have a third proof in observations made upon myself in the course of at least fifteen years. I have observed that in this matter a man can without difficulty do everything that he undertakes to do. One can live for years in practical abstinence from alcohol, or take it occasionally, or use it habitually in moderation. I have myself been through all these courses, and I have made use of all sorts of alcoholic drinks. At various times I have suddenly changed from one course to another, and always without any difficulty. Therefore I look upon complete avoidance of alcoholic drinks as neither a knack nor a sign of special strength of character. If a man takes only an occasional nip, it is quite easy *for him* to avoid alcohol. I emphasise the " for him," because if, for example, a city man suddenly gives up

alcohol altogether, but clings to his city life, it is quite common for him to become "nervous." He is quite correct if he attributes it to abstinence from alcohol, but he is wrong if he thinks that a person accustomed to alcohol necessarily becomes nervous on giving it up, and that even in abstinence the "nervous system weakened by alcohol" persists. Such views are wholly erroneous. The city abstainer frequently becomes nervous because he keeps on with the causes of nervousness (city life, the immoderate use of coffee and tea, etc.), but gives up the only agent, alcohol, that tends to prevent nervousness. It is always easy, therefore, to become an abstainer, but to remain one depends on a great number of circumstances that in themselves have nothing to do with alcohol.

Thus we have considered the alleged difficulties connected with moderation and excess in the use of alcohol. I hold them to be imaginary, for they disappear when we cease to split hairs and no longer measure moderation by grammes or cubic centimetres, but judge of it by practical life.

My rule, then, may be thus expressed: He is certainly a moderate alcoholist (we

say, I am a smoker; why should we hesitate to say, I am an alcoholist?) who takes as much alcohol as agrees with him, and no more. Is that a mere phrase? I think not. Everybody knows what this rule amounts to, also that it is easy to follow and that it is the guide of those who use alcohol in moderation. Our organism is so happily constituted that it always gives us warning if we are requiring too much of it or are treating it unsuitably. And since it is elastic enough to recover if we occasionally overtax it, he is no immoderate alcoholist who on occasions drinks a little more than he requires. Therefore, dear reader, as regards a definition of moderation, I say it cannot be made. Whoever is more or less indisposed in the morning knows well enough that he has drunk too much the night before or has taken some drink that was unsuitable for him. The head or the stomach or the sense of weight or the belly or the facial expression tells him so. As a matter of fact, then, it is very easy for a man soon to learn with certainty what he can regularly bear well in quantity and quality of alcoholic drinks. Of course anybody who has a definite disease must ask his physician.

The following is a résumé of our three general points: The alcohol of alcoholic drinks does not in itself possess the property of leading a person to drink constantly more and more. Moreover, it is very easy to keep the consumption of alcohol within due bounds. Finally, a man learns well enough as a rule the quantity of alcohol that he can take without harm.

II

ON THE MORBID PROPENSITY TO DRINK

One must constantly bear in mind the statements with which we concluded the last section if he seeks to understand the type—I mean the chronic alcoholist or toper—that plays the leading part in medicine, or if he wishes to concern himself with the possible and the actual relation of alcohol to the occurrence of morbid conditions of the organism. Nobody will expect me to give here a description of the toper. It would be wearisome and superfluous for the reader, for the type has been thoroughly known from time immemorial. It would be more interesting if the following questions were to be raised: How does a man become a toper? How does it happen that, though the majority of men go through life using alcohol moderately, the minority drink to excess? In many countries, indeed, this minority is disappearing. I believe that the question answers itself. If—and everybody

knows it to be the case—by far the greatest number of consumers of alcohol do not end as topers, it follows with perfect certainty that the cause of drunkenness lies neither in alcohol nor in alcoholic drinks, but in peculiarities of the individual affected. To an exception to this statement, one, however, that is not common in Germany, I shall recur farther on. As a rule, therefore, the cause lies in the particular circumstances and attributes of the persons themselves, mental abnormities or misfortunes. The reason why they drink is that they seek stupefaction. This need not always go to the extent of complete unconsciousness. A certain clouding of the consciousness commonly suffices. But, physiologically, this is stupefaction.

We all know why it is that the unfortunate, whether the cause of his trouble is external or internal, seeks for stupefaction. We know also that material or sentimental misfortune—which can find lodgment in the breast only of him whom it renders profoundly unhappy, who sees no escape—does not in many cases drive a man to drink unless he is already a "weak character." In many instances, therefore, an internal cause is added to the external one, and it takes its rise in the mental constitu-

tion of the affected person. There are even men devoid of "internal resisting power." We do not say this to play the Pharisee with them, or to deny that misfortune sometimes unsettles a firm fellow and leads him to the bottle, but because great numbers of "drinkers from misfortune" are besotted by their own mental qualities quite as much as by external conditions.

A "weak character" is not by any means a "weak-minded" person. There can be no question of that. The athletic character, he who opposes misfortune invariably and to the end, is rather rare. Oftentimes it is very difficult to distinguish the character that in the strife of life withstands every enduring misfortune from the one that simply is at heart an unfeeling man, consequently a man with a mental defect. In short, and the reader will agree with me, it is not prudent to go into too much detail in this matter; and it is not necessary to do so, since we are interested only in this point, that it is admitted that he who drinks on account of misfortune commonly has, in addition to the outer circumstance, an inner incentive, weakness of character. But this is very sharply distinguished from the mental

abnormities, to which we now come, by the very fact that he drinks on account of inward and outward causes (weakness of character plus misfortune), while he who is mentally abnormal does so only from internal causes and by reason of his abnormal mental constitution. Concerning the latter, the public is not sufficiently aware that very many morbid mental conditions are accompanied by such tormenting feelings as drive the person to the immoderate use of alcohol. And here it is to be said that often drunkenness is not the cause of the mental abnormity, but its manifestation, a fact well known to every alienist.

On this account therefore it is conceivable that in its discussions the public makes alcohol out as too often the cause of mental diseases. Take, for example, the contemporary statistics of the annual admissions into the lunatic asylums. They are published every year, and it is not uncommon to see it set down in them that so and so many chronic alcoholists (therefore topers) were admitted. We will assume that it is stated in the reports that fifteen per cent. of the persons admitted were chronic alcoholists. The professional man who glances at the report naturally says to himself that so

and so many of the fifteen per cent. had been drinkers, having been taken from their homes as mentally abnormal, but that only a portion of the fifteen per cent. were made insane solely by the abuse of alcohol. And even if all of them had been taken to the asylum in a condition of delirium tremens, the professional man could not decide differently.

In short, we know that generally a pre-existing mental derangement is the cause of the propensity to drink, and that the number of nervous systems wrecked by alcohol is actually smaller than that of the persons who are received into institutions for the insane, the weak minded, etc., bearing the marks of the abuse of alcohol. That is all. Unfortunately, the sources of error mentioned cast their shadows farther. What good does it do me to learn that in the cases of so and so many of the hereditarily insane drunkenness was recognised in the parents? It tells me very little, for, since so and so many drink because they are already not quite sound mentally, we do not know how many of the children of drunkards are hereditarily affected for the reason that their parents drank and how many because their parents were originally unbalanced

in mind. In the latter case the offspring might be hereditarily affected mentally even if the parents had not been drinkers, and of this we can be tolerably sure because experience shows that the progeny of the mentally unsound (whether they have used alcohol or not) are apt to be affected hereditarily. The only thing that we know with regard to this matter is that the number of those who are hereditarily affected on account of mere drunkenness on the part of their ancestors (or some of them) is smaller than the number of those hereditarily affected in whose parents drunkenness has been recognised.

NOTE.—Although the connection between alcohol and crime is not directly concerned here, I will take the opportunity to remark upon a few points that may here be considered. We must distinguish clearly between misdemeanours and crimes. Nobody denies that the greatest follies are often committed under the influence of drink. And we admit that between drunkeness and misdemeanours or unpremeditated crimes a connection is frequently to be found. But a connection between drink and premeditated crime is much more rare. We must not entertain the delusion that dangerous criminality is affected by restriction in the matter of drinking.

We find, then, that the causes of excessive drinking are, first, mental abnormities and, second, the association of misfortune with weakness of character in the person affected.

Both these primary causes lead the person to seek for stupefaction oftener than is good for him, and in direct consequence of the tormenting feelings with which they are accompanied. The yearning for stupefaction is the secondary cause which leads to the use of alcohol as a generally accessible means to the end. And since, as we shall see in the scientific part, he who drinks alcohol for the sake of stupefaction (to be sharply distinguished from him who drinks it for the sake of stimulation) is impelled on physiological grounds to take constantly increasing doses, he is of natural necessity on the road to sottishness, that is, to the continuous immoderate use of alcohol.

In fairness, then, we must deduct from a given number of drinkers those who were in themselves mentally abnormal before, also those whose character is so weak as to be unable to stand up against the misfortunes and obstacles of their surroundings. There remain those who become topers by the voluntary use of alcoholic drinks. And from this remainder we should except those who use alcoholic drinks containing fusel oil, thus leaving a second residuum of those actually made topers by alcohol. But such a sharp distinc-

tion cannot always be made, so that we have no idea as to how many men are made topers by alcohol itself. This reduces us to the ordinary experience of life, and with that and logic together we must seek to make a picture. And here I must say that the older I grow the less am I able to believe in domination by alcohol. In every case of notorious sottishness of which I have knowledge either spirit containing fusel oil was used or there was some mental abnormity or personal misfortune affecting the life of the individual.

The correctness of this exposition is further shown by what we know of the distribution of drunkenness. Wherever seductive alcoholic drinks are used, choice wines, well made beer, fine liquors, drunkenness plays quite an insignificant part. In the social strata in which there are the most topers the drinks in vogue—usually very ordinary spirits—are really not at all attractive, so that it requires a good deal of resolution to swallow them. There the use of alcoholic drinks is in a high degree associated with unpleasant feelings, and the person takes them as he would take a nauseous drug, for the sake of the effects. Drinking enables him to bear the transitory disagreeable feel-

ings and its effect is to eliminate their otherwise lasting impression.

It is to assuage the persistent feeling of misery, then, that many a mentally defective or unfortunate person drinks, and for that purpose it is not "alcohol" that he uses, but "alcoholic drinks." As a rule he is not content with drinks of which alcohol is the sole active principle, but after a while he generally craves those that contain fusel oil in addition to alcohol, like many distilled spirits. The distribution of drunkenness in Germany shows that wherever common spirit is the customary drink it plays a greater part than where, for example, beer takes its place [3]. And in foreign countries districts and social strata known for drunkenness are those characterised by the notorious use of spirits containing fusel oil, yea, even in better circles whoever drinks alcohol for the sake of stupefaction takes such spirits in course of time. Naturally he does not own up to it, for he knows the dram drinker's bad name; but he does it. Hence there arises the question of whether drunkenness is not in great measure to be attributed to the fusel oil rather than to the alcohol.

That is possible, for we now know by scien-

tific investigations (which, unfortunately, are still too seldom resorted to) that in general and in particular the action of fusel oil is quite extraordinarily more intense than that of alcohol. We know that fusel oil acts from ten to a thousand times as intensely, according to the organ examined. I have made my own chemical experiments, and I must say that only he who has not dealt with them can underrate the significance of these constituents.[1] It does not invalidate this position to say that fusel oil is present in only a small amount. In addition to the question of quantity there is that of the degree of activity, and that is very great in some of the fusel constituents. Moreover, it is not a mere matter of moderate consumption; it goes on immoderately for years. I am very well acquainted with districts in which the ordinary man takes with every meal drink that is by no means absolutely free from fusel oil, but in which the social condition is such that the people are moderate in the matter of all alcoholic drinks, even those that contain fusel oil. There is under such circumstances

[1] I need not write absinthe, which plays a great part in France and upper Italy, for to ascribe its action to its alcohol would be like imputing poisoning with laudanum to the solvent of the opium, namely alcohol.

no danger in the fusel constituents of the dram, which in Germany are kept down to a minimum by legal enactments, and the people grow old, sometimes very old, in a state of health and efficiency. In short, the question of whether or not alcoholic drinks contain fusel oil is of importance only when, for the reasons above stated, people take them immoderately for years together. Then it is a matter of much moment for him who takes alcoholic drinks for the sake of stupefaction whether ethyl alcohol is the active constituent or fusel oil. Experience clearly shows that drunkenness is of real importance only where the latter is the case.

Pray let me not be misunderstood. It cannot be denied that he who uses even ethyl alcohol immoderately and in a concentrated form may become a notorious sot. But this, we hold, is a very rare occurrence in actual life, and we do not deny that alcohol plays a part in the drunkenness that results from the immoderate use of concentrated alcoholic drinks and those containing fusel oil. But that does not settle this question: It is possible for a man to drink himself into a drunkard if he uses alcohol only so concentrated as it exists in light and medium strong beer and wine?

We will now simply mention that where topers are neither originally abnormal mentally nor too weak in character to bear their misfortunes, they are generally men who in their childhood had a senseless longing for strong alcoholic drinks, and those are the only instances in which we may say that the original cause of drunkenness was the use of alcoholic drinks as such, and, since it is for the most part spirit that is used, the part played by alcohol itself is still somewhat doubtful. We ask if the fact of the existence of notorious drinkers and the causes that lead men to drunkenness are reasons why a moderate man should renounce alcoholic drinks. We answer this question No! No reasonable man will give children distilled liquor to drink, and people other than children use alcohol not for use of alcohol not for stupefaction, but for stupfaction, but for stimulation. They are under quite different conditions, which will be particularly emphasised in the scientific part. The craving for constantly repeated stupefaction is lacking with them. Where this latter urgent cause is not present the regular use of alcohol never leads to drunkenness.

III

THE IMMODERATE USE OF ALCOHOL AND BODILY DISEASES

We have already spoken of the long continued excessive use of strong alcoholic drinks, especially distilled spirits, which ends in drinkers' insanity. The victim is the "chronic alcoholist" of the alienists. If the primary cause of drunkenness lies not in alcohol, but in the other circumstances that have been pictured, and the alcoholic drink is only the means to an end, there is reasonable certainty concerning another point, namely, that whoever has delirium tremens owes it to the exclusive use of the "means to the end," therefore to the immoderate use of alcoholic drink, usually the persistent excessive consumption of distilled liquor.

Proceeding to the purely physical diseases that have been ascribed to alcohol, we find a certain difference. These diseases are calci-

fication of the walls of the blood-vessels, atrophy of the liver and kidneys, fatty and other degenerations and dilatation of the heart, and gout, and before entering upon their consideration we must be careful to state the question clearly. It seems to me that, as regards these diseases, the only aspect that interests the public is connected with the question of whether or not and to what extent there are exact and positive scientific data showing the connection between their occurrence and the moderate use of alcohol by healthy persons.

It is not necessary to describe all these diseases or the deviations from the normal bodily condition which sometimes amount to disease and at other times to merely "the weak side of the system," whose subjects seek to know what alcoholic drinks and how much they may take. That can be affirmed only by the practising physician according to the individual case, and I shall here restrict myself to the statement that not all such patients need to abstain wholly from alcohol. It is much less harmful to gouty patients to take a glass or two of light wine daily, after the manner of a liqueur, and to live moderately in other respects than it is to abstain wholly from alcohol

without restricting the food and other drinks. For those affected with heart disease, too, it is less injurious to take a small glass of wine at the table than to give up alcohol altogether without cutting down the great amount of other liquids taken. But with all that we are not at present concerned, for in the foreground there stands the question, Are the relations of alcohol to the occurrence of the bodily abnormities mentioned rendered so certain by exact scientific observation as to require persons free from such abnormities to refrain from alcoholic drinks? The answer is No. These relations are nothing of the sort.

The public is very apt to think that whoever takes alcohol, no matter how moderately or what the form of the drink, exposes himself to these abnormities, and I often imagine that this comes from the fact that the public reads medical books, and among other causes of disease finds "chronic alcoholism," which it simply identifies with any regular use of alcoholic drinks, and then comes the picture of those diseases like a bundle of swords of Damocles hanging over the head of him who takes a glass of Rhine or Moselle wine.

This fancy is not justified. It is self-evi-

dent that the "chronic alcoholism" of medicine is always associated with the protracted immoderate use of alcohol, for as soon as we pass from this to the reasonable use of alcohol by moderate men there is no further special connection between it and any sort of disease. So on this point the public need not be anxious, especially as, even in cases of immoderate consumption, the connection in question is not always exactly made out, particularly with regard to the ethyl alcohol contained in the drinks. This is soon shown if we bring the whole question to a sharp focus. In practical life we meet with three sets of facts: (*a*) As a rule notorious drinkers sooner or later show one or another, often several, of the bodily abnormities mentioned. Nevertheless—and I could give details of personal observations—not a few of these persons reach the age of seventy and over, and stick to their calling up to such an age. That tallies with the fact that drinkers are always found among the oldest people. (*b*) There are many instances of persons who, without quite being topers, take all through life their good glass of wine, beer, or liqueur, and never show these abnormities. (*c*) There is no lack of persons who have used

alcoholic drinks much less freely than those mentioned under *b*, using only a minimum, and yet have one or another of the diseases in question.

Such are the facts. It cannot be maintained, therefore, that he who abstains from alcohol has a much greater prospect of escaping the diseases mentioned than the moderate alcoholist. It is only when we compare the abstainer directly with the toper that we find the former with the better prospects.

Therefore we may here say at once that, of the various causes that may produce the diseases in question, there can come into play only the continuous notoriously immoderate use of alcoholic drinks. Now, it is naturally of the highest importance to know how frequently such is the case and what part is played by ethyl alcohol itself. Unfortunately we cannot at present answer this question satisfactorily. We know, for example, with regard to premature calcification of the walls of the blood-vessels [4], that in twenty-five per cent. of the cases there is present "chronic alcoholism," therefore chronic immoderate use of alcohol. That ought to be a clue. But, on reflection, we find ourselves un-

certain if even seventy-five per cent. of the cases are not connected with chronic alcoholism. Then somebody exclaims: If three quarters of the cases occur independently of alcoholic drinks, then there are so many cases of arteriosclerosis (the scientific term) thus produced that, among the twenty-five per cent. accompanied by chronic alcoholism, certainly there are so and so many that would have occurred without it and must have been due to some other cause.

We do not know, then, how many persons become affected with arteriosclerosis in consequence of alcoholic drinks. We know only that they are fewer than twenty-five per cent. That is the only logical conclusion possible, and the cause becomes much more uncertain if we inquire with regard to the part played by drinks containing ethyl alcohol itself. Not only on the strength of statistics, but also on that of certain experiments, we have reason to assume that the continued immoderate use of ethyl alcohol itself, especially the immoderate use of concentrated alcohol, may produce arteriosclerosis. But according to statistical data alcohol alone plays no part; the much more potent fusel oil enters into the question

(with many dram drinkers), and in other cases there is the surcharging of the circulation with fluid (with immoderate drinkers of beer and wine), which, together with the concomitant overnutrition of the individual, is sufficient to wear out and damage the walls of the blood-vessels. This may have its effect quite independently of the substances contained in the drinks.

In order, therefore, to ascertain the number of cases occasioned by the use of alcohol, we must deduct from the twenty-five per cent. all those in which arteriosclerosis would have occurred without alcohol. That gives a first residue, and from that we have again to deduct all those in which fusel oil or colossal cramming of the circulatory organs with fluid may have caused arteriosclerosis. Thus we get a second residue, and this shows the part actually played by alcohol itself. By the simple procedure of ascertaining whether in cases of arteriosclerosis there is concomitant chronic abuse of alcohol or not one will never arrive at a solution of this question, and this method must, for the reasons given, result in too sharp a charge against alcohol, and since this simple method is so commonly appealed

to in all the diseases mentioned, when the attempt is made to ascertain the relation of alcohol, my objections to it in connection with arteriosclerosis may be applied to the other diseases. It is therefore a task of the utmost difficulty, for the most part at present impossible of performance, to determine the part played by alcohol in the production of these diseases, even in cases in which the fact of chronic abuse of alcoholic drinks is established.

Atrophy of the liver depends very decidedly upon the circumstance that the subject used alcoholic drinks that were concentrated and contained fusel oil. In England it is called "gin drinker's liver," which we may translate "the liver of spirit containing fusel oil," for if the physician has to deal with a community that drinks beer or wine, he may enjoy a large practice for many years together without meeting with a case of the disease. Here, quite as with dipsomania, it is important to know positively if atrophy of the liver occurs in those who use exclusively light and medium heavy beers and wines.

As regards the consequences of the immoderate use of beer, one may say at the present time that probably it is only to the slightest

extent that they can be imputed to the alcohol contained in the beer, for the immoderate beer drinker and the immoderate drinker of spirits are in this respect as unlike as possible. I may say that, if the spirit drinker shows rather the outward marks of shrinkage (being lean, ill nourished, haggard, and dried up), the immoderate beer drinker shows corpulence broadening, and relaxation (being fat, puffed up, and well nourished). In short, the purely external distinction is so great that without further thought one may say that both the alcohol contained in spirits and that contained in beer (in each case the same ethyl alcohol) lead to nothing more than a certain modification of figure. But in both sets of symptoms a very important part must be ascribed to the non-alcoholic constituents of the drink. In the case of spirits the fusel constituents are prominent, if there are any, and in beer the rich carbohydrates and especially the much increased consumption of fluid as such. While therefore with the dram drinker the nervous symptoms and those of atrophy predominate, with the beer drinker the circulatory symptoms are always prominent (dilatation, softening, and fatty degeneration of the

heart), and to them is added in cases of excessively immoderate use of beer atrophy of the kidneys, which, however, is not now attributed to the alcohol in the beer.

And so, for example, it is now very probable that the so-called " beer heart " has but little to do with alcohol. This really has its origin in overnutrition (with the consequent deposition of fat in organs in which fat cannot be used) and in the colossal overtaxing of the function of the heart. I have known persons who drank more than nine quarts of beer daily. Now, all this liquid has to pass through the heart and the blood-vessels before it can be eliminated from the body. Upon this depend nine tenths of the consequences of immoderate beer drinking. That has been proved to me to the extent of my having observed how the same affections of the heart occurred to persons who took little alcohol and none regularly, but in other respects were very good livers, and drank a great deal of coffee, water, etc. A man can quite ruin his blood-vessels and his heart by daily increments of the fluid ingested, even if it be only water.

The results in cases of continued immoderate use of alcoholic drinks are as follows: It

cannot be denied that it may cause the diseases mentioned (atrophy and degeneration of tissues or organs). But I say that we do not know how often that actually is the case, and I must come to the conclusion that it is not so frequent as statistics apparently show. I say, further, that we are much more in the dark concerning the part played by alcohol, and that it is accused too pointedly and with too much prejudice.

IV

THE MODERATE USE OF ALCOHOL AND THE OCCURRENCE OF DISEASES

We come now to a question of the greatest importance to us, namely, that of the relation of the diseases mentioned to the regular moderate use of alcoholic drinks, or, more correctly expressed, to the question of whether there really is any such relation. I say that this is the most important question connected with the whole subject, the only one interesting to the public, because nobody is astonished or disquieted if the immoderate use of these drinks causes diseases, for nobody expected anything else. But it would be disquieting and notable in its bearing on human experience if even the moderate use of these drinks caused disease. As a matter of fact, I do not know of an instance in which the moderate use of good alcoholic drinks has given rise to disease. I am quite well aware that an effort

is now being made to connect, not only gout, but also certain heart diseases with the moderate use of good alcoholic drinks, and even the best, but I hold, not only that this attempt is without adequate scientific support, but that it is scientifically unjustifiable. At the first glance, indeed, the facts seem difficult and the outlook for the friend of a good glass of wine or beer looks cloudy. The fact that gout attacks by preference those persons who have lived well and still do so, and the fact that heart diseases, of which I shall speak further, occur preponderatingly in well nourished persons in good circumstances, do not present the question. Now, naturally, whoever among us "lives well," in accordance with prevailing custom, takes very good alcoholic drinks along with all the other good things which must not be forgotten. Indeed, I go still further. I am not at all in accord with the statement that alcoholic drinks play a certain part in the diseases of those who for years have lived well. The connection is quite different from what it is with the toper, and it is here not a question of the "specific action" of alcoholic drinks, but without exception that of the overnourished person, with whose diseases every substance

taken has something to do, provided it nourishes, and therefore alcoholic drinks in so far as they are nutritious.

Each and every alcoholic drink nourishes simply because it contains alcohol, which belongs to the nutrients (compare the appropriate paragraphs in the scientific part of this treatise). Such drinks are nourishing in varying degrees because they are differently constituted, that is, they contain different amounts of other nutritive substances. That, too, is pre-eminently true of good beers. And because alcoholic drinks are not mere beverages, but also nutrients, beer being particularly rich in nutrient substances, they tend, like all other nutritive substances without exception, to set up overnutrition whenever the general mode of life of the individual favours such a result. That is the case under the best of circumstances when high living is associated with insufficient muscular exertion.

But that is the class peculiarly subject to gout and to dilatation, relaxation, and muscular degeneration of the heart, which become extraordinarily less common when we come down to the poor or to those who, while they may indeed live well, use up their surplus of

rich food by regular and strenuous muscular work. So the overnutrition is not the consequence of good living, but of that plus insufficiency of muscular activity. The two should never be considered separately. Hence the very important fact that we can be the less careful about food and drink (including alcoholic drinks) the more muscular work we do daily.

There can be no doubt that we possess the most important "exhaust" in our muscular work. But in order that this apparatus may work properly, there must be actual muscular exertion, and it must involve as many of the muscles as possible, a condition that is by no means fulfilled by every sport or by the conditions of prosperity incident to modern life as enjoyed by those who "live best." In consequence of this deficiency, the nutriment is not used up, and so it goes to promote stoutness. It causes a deposit of fat, which, however, is not the only consequence of overfeeding. We can all picture it, and we know what it unfortunately means, but we know also that it has not been sufficiently studied. The organism not only is burdened with a deposit of superfluous nutriment, but it strives to free

itself from it as much as it can, and consequently quantities of decomposition products are constantly formed, and they wear out the organs charged with their elaboration and elimination. It is in this respect that the excessive ingestion of albumin is particularly injurious. And too great an ingestion of liquids has the same wearing effect on the circulatory organs and much more.

While many of the procedures of our modern life have unexpected consequences, always diminishing our muscular work more and more (think of the facilitation of transportation when it would be better for many to go home on foot from the office or the factory), on the other hand there is contributory the prevailing desire to know the nutrient value of whatever is consumed, together with the erroneous view that alcoholic drinks are solely beverages—all ending in overnutrition.

I hold it to be distinctly dangerous for a man who does no active muscular work to take alcoholic drinks, especially beer, simply as a beverage. It cannot be too much insisted upon that they also nourish and that the rich beers are highly nutritious. It does not necessarily result that a person must avoid these

drinks, but that he must take their nutrient power into account if he lets them figure in his daily life. If a person drinks a certain number of glasses of beer in a day, he must reduce his other nutrients in proportion. And the more freely a man takes alcoholic drinks, especially good beer, so much the more must he cut down the amount of his other food. Thus only can he adjust the total of his food to the conditions of health.

Therefore he who drinks a glass of wine, beer, or liquor need not be disturbed, but he must take into account the nutrient matter of these drinks, just as at a dinner he need not concern himself with the first course, but should bethink himself of the nutritive value of the succeeding courses. If one chooses not to limit his food, he must put in muscular work accordingly. It is certainly no accident that diseases of the overnourished, such as gout, relaxation and dilatation of the heart, and premature degeneration of the muscular tissue of the heart and of the blood-vessels, occur much more rarely in those who, whether from poverty or from regard for the old demonstrations concerning alcoholic drinks, are careful about them. Persons of the latter

class reckon very closely with the nutritive value of alcoholic drinks, especially beer.

Having settled this point, we must make it known that we here have to deal with the consequences of overnutrition and not with the specific effects of alcohol. It must be recognised at the outset that in this matter it is a question, not of "views" or of "hypotheses," but of an exposition well founded on facts, and, in the second place, that, as has been said, overnutrition has been too little studied to enable one to follow it in its ultimate connections. Not only is the overnourished person corpulent, but he furnishes the chief contingent of the gouty, those who become prematurely arteriosclerotic, those who at about the age of fifty-five or sixty suffer with heart trouble and die of that or of some other sudden attack.

Everybody knows that corpulence depends on overnutrition, but it ought to be known also that the special diseases here mentioned are dependent on the same cause, and not on the specific action of alcohol. Therefore I shall not content myself with simply referring to those passages in the scientific part in which it will be set forth how little the moderate use of alcohol has to do with the muscular struc-

ture of the heart. But I shall adduce certain facts that are more convincing than the experiments thus far mentioned.

Let us see, then, what cases they are that we are dealing with. Generally it is a person beyond forty years of age, tall or short, but always corpulent, belonging to a class that do not limit their food and drink to what is necessary. (The poor are hardly ever affected.) They have lived well for years, that is, they have taken abundantly of the best that the kitchen and the cellar afforded. Neither their calling nor their temperament involves bodily exertion, but permits of their avoiding it. As a rule they are mentally well equipped, very often they are persons of prominence, and their children are usually healthy. Thrifty and prosperous, they live a life of ease until with advancing years some one of the diseases mentioned sets in. The following considerations show that with them alcoholic drinks have operated as nutritive material among nutritive materials, and not specifically as alcohol:

a. The persons affected hardly ever show the actual, indubitable effects of the immoderate use of alcohol, the specific symptoms of the

toper. I have already said that it is mentally that they often play a prominent part, and not alone in the field of fancy, but in practical life, in situations demanding the keenest intelligence and often an iron will. These cases are of the highest importance because in his fifties a man is frequently laid up with paralysis, which nobody would have expected, in the flower of his capability, who in his situation was a power of the first rank and who has a number of healthy and often very capable children. In short, there is no trace of the mental effects of alcoholism.

b. Side by side with such cases we may often place a certain number of others in which not one of these diseases exists, either heart affections or premature calcifications or gout, though the persons have often kept on taking increasing amounts of alcohol in the form of alcoholic drinks. They are those in whom there is no overnutrition, as the first glance at them shows. They are persons who either are two poor to "live well," or, being able to do so, give their muscles regular and adequate exertion, whether from temperament, from inclination, or from the requirements of their occupation, or, though they take

alcoholics in abundance, are particularly moderate in other respects.

c. By the side of these we may place still other cases in which through life the use of alcohol has been insignificant, and yet at the age of forty or fifty affections of the heart occur. It is certain that in this third set of cases there is no question of overnutrition. Not infrequently these affections of the heart attack women at the same time of life, and in districts famous for good living. For the rest, the women are in the best of circumstances.

The result is as follows, then: We meet with gout and with the heart diseases mentioned in cases of overnutrition (which means an excess not only of fat, but usually of albumin also), quite without regard to whether the affected persons were fond of alcoholic drinks or not. But much more rarely do we meet with these cases where there is no overnutrition, independently of whether the persons took no alcoholic drinks at all or took them freely, often very freely.

This having been established, we must now deal with a further point: It may be imagined that in the overnourished alcohol acts all the more " as such " because it is not oxidised in

the body so rapidly as in those who are not overnourished. To simplify this point, I will here remark only briefly (for it will be thoroughly set forth in the scientific part) that for the most part we use up the alcohol ingested, which therefore disappears "as alcohol." Transformed alcohol is alcohol no longer. We will say, further, that we use up the nutrient alcohol the faster the more muscular work we do and the less we take of other nutrients. Hence it is quite natural that the overnourished person who is not very active does not so quickly oxidise alcohol that it can no longer act in him as such, for then the deficiency of muscular exercise leads to less need of nourishment and calls for a reduction of other nutrients (albumin, etc.). It seems to me beyond question therefore that in the system of the overnourished person the alcohol of the wine taken circulates longer as alcohol than in that of a person who is not overnourished, and it may be imagined that thus in the course of time the alcohol becomes pathogenic even when it is taken in moderation. I will not deny that for a time I myself thought so, but I must add that I soon became unable to regard this as the correct standpoint.

If it were really true that in the overnourished the alcohol taken by moderate drinkers circulated too long "as such," gout and the heart diseases mentioned must eventually be much commoner even in the poor than is actually the case. There are among the poor so many who, though by no means overnourished, take alcohol very often every day that it seems to me less important how long the "alcohol as such" circulates in their bodies than in those of the overnourished moderate drinkers in better circumstances. Nevertheless, the diseases in question are really more seldom met with in them, as has already been shown by the average greater duration of life.

Furthermore, the toper of the class in which there is no question of overnutrition, especially the notorious drinker who is not at the same time overnourished (therefore virtually the dram drinker, most rarely the beer toper, because beer is too nutritious), consequently the person in whom almost as a matter of course much more unoxidised alcohol circulates than in the moderate but overnourished alcoholists of the better classes, does not furnish the chief contingent of those who suffer with gout or the heart diseases mentioned.

Whence, otherwise, come the old topers? How, then, can it be the toper that chiefly comes to delirium? He must long since have succumbed to a heart attack if his heart is so extraordinarily more sensitive to alcohol than that of the toper whose nervous system has always been more or less affected.

The relations are different, then, and even in the face of these facts I cannot specially connect the gout and the heart diseases of the overnourished in better circumstances with alcohol, and in particular, as has been said, we hardly ever see gout or the heart diseases mentioned associated with the typical consequences of the too protracted circulation of an excessive amount of alcohol in the body, namely, the effects on the central nervous system, especially the mental results of the abuse of alcohol.

Even if in the overnourished person alcohol as such does remain longer unconsumed in the system, there is too little of it to ruin the organs. I see no other way out, then, than to ascribe these diseases to the overnutrition itself, and only because, in the presence of the latter, everything that is particularly nutritious, without exception, promotes and con-

tributes to overnutrition, and alcoholic drinks among the rest, since from their entire constitution they must act as nutrients and not specifically upon the organs.

It practically follows from the foregoing that one cannot by renouncing alcoholic drinks avoid the gout[1] and the heart diseases mentioned which affect so many able men in good circumstances about the fiftieth year and often earlier. One should rather avoid overnutrition or seek to correct it if it is already present. And that is not incompatible with the moderate use of alcohol drinks if one is careful to take enough exercise and is moderate in eating and drinking. He who gets weighed from time to time and keeps watch on his appearance (his girth, etc.) may always be sure whether he is overnourished or not.

Conclusion of this chapter: A special relationship between the use of alcohol and the occurrence of diseases has not been made out so far as regards the moderate use of good alcoholic drinks.

[1] The few cases of "gout of the poor" play no part in this matter, and are easily explained otherwise.

V

THE USE OF ALCOHOL AND THE CURE OR PREVENTION OF DISEASES

It is tolerably self-evident that medical experience of the use of alcoholic drinks for strengthening and treating sick persons reveals nothing against the moderate use of alcohol. Indeed, it speaks in favour of it, and usually the employment of alcohol in medical practice is opposed only by teetotallers. At present there seems to me to be little probability that clinical medicine will consent to the elimination of alcohol from its stock of remedies, and such will always continue to be the case, because the use of alcohol in the sick-room is by no means the survival of an old routine, but is securely founded on experience now confirmed by special physiological investigation in almost every particular. The scientific portion of this treatise will show in all its details that the physician who

prescribes alcoholic drinks for the sick in accordance with experience stands thoroughly abreast of modern science.

Now, manifestly, it is not incumbent on me to enumerate here all the cases in which the physician orders alcoholic drinks. That belongs to the text-book of therapeutics, and necessarily, because the physician has to individualise according to the requirements of the case. It is in the administration of alcoholic drinks to the sick that the experienced practitioner rises superior to theoretical speculation. The modern physiological investigation of alcohol is sustained in so far as it is in agreement with what medical experience has established, which it explains as scientifically founded, and the progressive physician finds in it more to favour the freer use of alcohol in the sick-room than to restrict it. Extraordinarily more common, consequently, are the cases in which the physician prescribes alcoholic drinks, and, be it understood, not merely as a means, as a vehicle, for supplementing other substances in the deranged organism, but quite directly for the sake of the peculiar action of these drinks.

From the earliest childhood to the most ad-

vanced years, there is hardly a period of life in which wine is not ordered with the best results. Only there is this difference, that in childhood alcohol is given purely as a medicine, while in adult life it is used partly as such and partly as a dietetic agent, to be used more and more as a beverage and as a nutrient. According to the object aimed at, the amount to be used is naturally variable. Where it is to be used steadily, it may be taken to the extent of a bottle of wine daily, together with a glass of cognac. Where it is used rather for its mere medicinal effect, the variation is greater, and, according to the case and the time of life, the amount may range from a coffeespoonful of Tokay, diluted with water and given in the course of from twelve to twenty-four hours, for a nursling, to a whole bottle of heavy wine to be given under certain circumstances to a very weak feverish person.

What the physician wishes to accomplish is of importance, whether he simply aims to stimulate the digestion or to allay nervous irritability, whether failure of the heart is to be prevented, whether nutrition is to be promoted (alcohol is a nutrient easily taken and very readily absorbed), or whether the distribution

of blood is to be affected, etc. All these considerations appeal only to the physician and not to the laity. It is enough for them to know that the physician, even when he orders alcoholic drinks for them, stands wholly on scientific ground and need not be regarded uneasily. The layman need not be puzzled if he notices that his physician restricts the use of alcohol by certain other patients or forbids it (the latter, for example, in many cases of kidney disease). In this respect alcohol is in no peculiar position, but is in company with the best recognised beverages and nutrients. Celery and asparagus are also reduced to a minimum in kidney diseases, and sugar in diabetes and albumin in kidney disease and gout. Nevertheless, in other cases the doctor allows carbohydrates and in still others albumin liberally. His directions relate wholly to the particular case, and nothing would be more unscientific than to treat all cases alike. If, then, one seeks to deduce from all this great field something of direct importance or only worth knowing as a generalisation, it can relate, so to speak, only to such points as play a part in the daily life of the individual patient; points which in the ordinary life of the

laity must not be wholly lost sight of. Here I have less in mind the significance of alcohol as a nutrient and less the fact that a stiff glass of grog taken at the right moment aborts many a chill in its beginning, or the employment of alcohol in weakness of the heart, because in such instances the physician must be on the spot in person; I have in mind much more the significance of alcoholic drinks for the degree of our nervous irritability and for the distribution of the blood in our body.

In regard to this, we must understand clearly what the terms distribution of blood and nervous irritability mean. As concerns the distribution of blood, that is quickly arrived at, for at the present day the laity are well aware that the blood in our body is not always evenly distributed, but that, according to circumstances, there is at a given time more blood in the skin or the muscles, and consequently less in the internal organs, or, *vice versa,* less in the skin or muscles and more in the internal organs. According to the needs of the organism and the conditions of life, the distribution of the blood varies more or less, owing to the action of a nervous mechanism that regulates it (of which I shall have more to say in the

scientific part) and to the activity or inactivity of the muscles. As has been said, all this is perfectly well adjusted to the health and needs of him who is in a normal condition.

But naturally this does not do away with the fact that under certain conditions of life the whole distribution of the blood is often unfavourable. This happens, for example, when the one or the other distribution is favoured, as when the habitual daily work is such as to induce a lack of blood in the skin and gorge the organs with blood, or when, on the other hand, intentionally or unintentionally, those measures are avoided which tend to fill the skin with blood, withdrawing it from the internal organs. In all such cases there is an almost constant congestion of the internal organs, and it is self-evident that this may cause not only discomfort, but also actual disease of the organs—for example, intestinal diseases and those peculiar to women.

Such a course of life is seen in dwellers in towns, because for the most part they are without daily muscular exercise. Unfavourable as this is in itself, it may to some extent be counterbalanced if such persons will use means that favour a flow of blood to the skin, for

thereby they will relieve the internal organs of blood. But among all our articles of food and drink the only such are alcoholic drinks, in consequence of the alcohol they contain. In the scientific part we shall show more thoroughly that they dilate the blood-vessels of the skin, but constrict those of the internal organs, thus relieving the latter of blood, for the repletion of the vessels of the stomach that they produce is a local effect, restricted to the stomach and lasting only so long as the alcohol remains in it; that is not very long, for the alcohol is very rapidly absorbed from the stomach into the fluids of the body.

It is therefore unquestionable that the use of alcoholic drinks plays an important part with the modern person who is not muscularly very active, and they are all the more necessary for him because he takes more of other articles, such as coffee and tea, which possess the special property of lessening the blood in the skin and sending it to the internal organs, than were used in former centuries (for coffee and tea were first introduced into Germany in the seventeenth century and were not very generally used before the second half of the nineteenth century). This property of

tea and coffee is owing to their active constituent, caffeine, which with absolute certainty constricts the blood-vessels of the skin and dilates those of the abdomen. So certain is this that a learned man experimenting with caffeine became affected with hæmorrhoids during the experiment, and they disappeared when the use of caffeine was discontinued—a fact known, for that matter, for the last thirty years [5]. And, true as it is that the laity very seldom drink daily enough strong coffee to equal the amount of caffeine used in this experiment (although the average consumption of coffee by us is most incredible), the experiment shows strikingly that with our coffee and tea we are daily ingesting a substance which especially narrows the blood-vessels of the skin and enlarges those of the abdominal organs.

We thus see, then, that there is nobody in more urgent need of the regular daily use of alcoholic drinks than the modern man who takes little exercise, but often takes coffee or tea with his breakfast, after dinner, in the course of the afternoon, and frequently in the evening. His mode of life disposes to stagnation of blood in the internal organs. We see, further, that knowledge of this specific ac-

tion of alcohol on the one hand and of caffeine on the other is very important for every layman. But I do not think it necessary to strike out coffee and tea from the list of articles taken daily. Only it is not correct either to use an article of luxury immoderately or else throw it overboard altogether; it is not right with regard to anything consumed. It would be doing too little in one direction and too much in another. And by so doing a man misses not only much of the pleasant properties of the article, but also much of its useful features. The only correct point of view is for a man always to be moderate and to govern the amount of beverages that he takes by the amount and kind of their activity. So long as he confines himself to his own wholesome experience, without regard to fashion, he will always get along well and can take coffee and tea without harm. It is not necessary, therefore, to avoid coffee and tea entirely, but it is necessary, especially for those who take but little daily exercise, and they are the majority, to take more alcohol than coffee and tea, as an instructive professional man informs the public. It is important to drink wine or beer at dinner and to accompany the cup of coffee

with a liqueur or cognac. But if a man will avoid alcohol altogether, I hold it to be proper for him to avoid coffee and tea at the same time. Either both should be taken in corresponding amounts (alcohol and caffeine) or none of either.

It is clear, then, that a modern person of little muscular activity who abstains from alcohol but drinks a good deal of coffee and tea, carries out the regimen best calculated to maintain an excess of blood in the abdomen, and it is not to be wondered at that such a person has digestive derangements, chronic constipation, hæmorrhoids, and diseases peculiar to women, with corresponding poverty of the blood and nervousness, much more commonly than they are met with where on the average the consumption of alcohol exceeds that of coffee and tea. The Romans, for example, though generally moderate in the use of alcohol, are still more so in that of caffeine. In German countries the amount of coffee consumed annually per capita is from five to eight times as great as in Italy or Spain.

Such is the state of the case with regard to the distribution of blood, and quite similar relations obtain in the matter of nervous irrita-

bility. As to what a nervous person is, the laity are tolerably well informed at the present time, although the relations are more complicated than in the matter of the distribution of blood. That a man of a sanguine or choleric temperament may go on for a long time without being nervous is well known. The hot-headed and the triflers are perhaps the least nervous; with them it is a matter of quite other conditions of the nervous system. We observe in them, in the first place, an abnormally heightened reflex excitability—a matter that we shall here mention rather cursorily, because we shall deal quite thoroughly with reflex excitability in the scientific part. The person with exalted reflex excitability suffers by the fact that his central nervous system reacts much more decidedly to external irritations and impressions than that of the man who is not nervous. And it reacts by muscular movements, partly by contractions and partly by general muscular restlessness. The nervous man's muscles contract more firmly than a healthy man's on sudden and strong external impressions. A continued source of irritation, such as the rattling of a waggon, a dazzling light, or loud talk, causes him a more

or less pronounced muscular restlessness. The whole phenomenon is involuntary. The nervous man is the victim of the reaction of his central nervous system to external irritants, without his willing it. His part in the reaction is that of a spectator who cannot much change what is going on, but is very decidedly affected by it, because the same central nervous system is the seat of his conscious mental processes. The involuntary reaction of his central nervous system to the external irritant gives him a concomitant continuous sensitiveness, and so continually disturbs the rest of his mental life.

If, then, the nervous person is doing something and for a moment directs his attention away from himself, it needs only that the rattling of a waggon or the loud crying of a child should strike upon his senses to disturb him. To such sounds, as has already been said, his central nervous system reacts at least with a more or less decided and general muscular unrest. An inclination to the most various movements sets in, and since all these movements obtrude themselves on his consciousness in the shape of muscular sensations, there are suddenly aroused in him mental processes,

corresponding to such sensations, which constantly thrust themselves into his remaining mental activity, disturb it, and hinder its flow. Thus he is diverted and it becomes very difficult for him to concentrate his attention. And since, in order to do what he wishes to do, he must continually and voluntarily strive against this fidgettiness and these muscular sensations, all this tends to hamper him, so that his work eludes him, fatigues him, and costs him labour. He then does everything convulsively, so to speak, that is, with an expenditure of mental and nervous energy that a healthy person would not need to exert, because the latter unconsciously overcomes the feelings that intrude upon his conscious life without having to battle against them continually. This he need not do, because his central nervous system does not react to every trifle with muscular restlessness or contractions, since he has no exaggerated reflex excitability. So it comes about that the nervous person has a very irritable central nervous system and is so easily fatigued. They call it irritable weakness or neurasthenia.

Now, the disease picture of neurasthenia is not really uniform, as is proved by the de-

scription of different forms, and so it may often be the case that exalted reflex excitability does not seem to be especially pronounced. But that does not in the least alter the fact that it is generally present in the nervous and is rather typical of the condition of nervousness. I may say that it is self-evident to him who understands physiology and psychology that this exalted reflex excitability, as soon as the exaltation reaches a certain degree and is tolerably permanent (and that is the case with the nervous person), causes the difficulties and disturbances of mental life that have been mentioned. So it is with the fixed ideas of the nervous that they have mailed a letter without properly sealing it, or that they have not really closed a door that they intended to close (in consequence of which they open and close it repeatedly), or perform many acts that seem laughable to the person who is not nervous; they are the result of being able to concentrate the attention only with an effort. But the latter is all the more difficult because the central nervous system is fatigued by the heightened reflex excitability, which is constantly occupied with reactions to external irritants that are but slightly if at all

present in a healthy person, but always confuse the nervous person if he does not laboriously "pull himself together."

Briefly (for I cannot here go deep into the matter, but shall return to it elsewhere), it is all the same whether the heightened irritability, the exalted reflex excitability, is the cause of neurasthenia or only a symptom of it; this much is certain, that it is to the interest of every nervous person and everybody with a tendency to nervousness to so shape his mode of life, so far as may be practicable, that his reflex excitability be not especially increased. Everybody concerned, and it is well known that very many are, must therefore so regulate his diet as not to heighten his nervous irritability, his reflex excitability. To that end, the public must be firmly impressed with the following scientific facts:

a. Of all the articles consumed by us, alcohol is the only one that reduces our nervous irritability, especially our reflex excitability.

b. The caffeine of coffee and tea heightens them.

Those are two indisputable scientific facts, fundamental facts, that everybody ought to know, because regard for them may at least

prevent many an unpleasantness. Now, I do not go so far as to counsel absolute abstinence from coffee and tea, because of course everybody disposed to nervousness may always take alcohol in proportion to the caffeine taken in the form of coffee and tea, but, if he chooses to eschew alcohol wholly, he must also abstain entirely from coffee and tea. I need not here repeat all that I have said in regard to the distribution of blood and its relation to the articles mentioned, but will limit myself to this: He who in modern life avoids alcohol altogether and takes a proportionately increased amount of coffee and tea must hold his abnormal mode of life responsible for the onset of nervousness or for its increase.

Often as we see heightened reflex excitability in the nervous person, manifest as may be its connection with the mental condition of the neurasthenic, it is doubtful, as has been said, whether it is the cause or the consequence. I have already remarked that many now look upon it as only a casual phenomenon of nervousness, the chief cause being mental overwork. The latter view does not in the least alter what has been said before. Even if mental overstrain is the effective cause of neu-

rasthenia, and the latter gives rise to heightened irritability (in a way readily understood by physiologists), it is still true, without exception, that the persons affected should not take articles which raise the reflex excitability still more, but rather those that reduce it. Avoiding alcohol while taking coffee or tea not only may but must increase the nervousness.

But in reality neurasthenics are not always persons who are mentally overstrained. The frequent occurrence of the trouble in women forbids the assumption that they are. And as a matter of fact neurasthenia is attributed to the most various causes. However that may be, it is certain that mental overstrain and hereditary taint are not the sole causes. It is much more probable that the rapid increase in the nervous characteristic of our times corresponds to the simultaneous increase of some factor that favours nervousness under certain circumstances. That is sure. It is not far to seek. The modern rapid increase of nervousness runs parallel with that of the consumption of coffee.

This fact is further supported by the following: In recent decades the consumption of

caffeine in Germany has made giant strides, and it is established by official statistics on the basis of the percentage of caffeine in coffee and tea that the German people consume annually several millions of kilogrammes, corresponding to about ninety times as much coffee itself. This colossal consumption of coffee is virtually concentrated in the cities and the manufacturing districts. Since fractions of a gramme of caffeine may under certain circumstances cause undoubted disturbances of health, all these facts, established by various authors and published as a warning, should explain the modern increase of certain diseases of the heart and of the nervous system [6]. On the strength of my own observations I must agree with these authors, though I do not, like many of them, think the entire avoidance of caffeine necessary.

We are living at present not merely under the sway of the moderate use of caffeine (against which I have nothing to say), but rather, in one region more than in others, but in many German districts quite decidedly, under that of a quite undeniably immoderate use of caffeine. On that particular point I have much to say. It is common to hear it remarked

that in the "coffee regions" weak coffee is generally used. But this is fallacious. On the strength of the weight of coffee beans consumed, it may be affirmed that he who takes his *demi-tasse* of Mocha with each of his two principal meals, but takes it strong, is far behind him who drinks weak coffee, but takes a great deal of it. On the average, the latter takes daily three or four times as much caffeine as the former, and often the difference is still greater.

Now comes the question as to whether it is nervous persons who are so very much given to the use of caffeine. Answer: Surely. What is it that the modern person who is mentally overstrained drinks as a rule in order to spur himself on? A great deal of coffee and tea—coffee morning and noon or afternoon and tea in the evening (often in the afternoon also). The third point here to be considered turns on the question, May not the caffeine contained in the coffee and tea account, not only for the exalted reflex excitability, but also for the other mental peculiarities of the nervous? Answer: Assuredly. Caffeine not only heightens the nervous irritability (reflex excitability), which in itself explains many of the

mental conditions of nervous persons, as I have shown above, but it also acts directly as an excitant upon the cerebral apparatus as such and quickens our perceptive and conceptive faculties as well as those which connect ideas (association apparatuses). Hence its use dispels weariness, and its immoderate use causes wakefulness. Consequently, used moderately and at the right time, it is an agreeable and useful article for a healthy person. But caffeine is used too frequently and in too great strength by those persons who constitute the majority of the overworked and nervous.

Now comes the question of whether too much recourse to the help of coffee has not given rise to the modern bustle (since he who uses coffee only moderately works better and with less haste, taking into account the quality of the work), or whether the strenuous life and toil of the present time have not forced men to the constantly increasing use of coffee. As a matter of fact, the two go hand in hand. To force himself to work, even when he is weary or has no liking for it, a man takes continually increasing doses of coffee, and thus causes excitement of the cerebral functions as such—perception, conception, and association

of conceptions—and the work itself urges him to greater haste and leaves him no rest, even if the task is done. Owing to this artificial stimulation, he now begins something new, for he is "not tired." To carry it out, he resorts to coffee again. And thus arises the "vicious circle" of the modern mode of life. Naturally these goaded nervous apparatuses are ultimately still more profoundly exhausted. Furthermore, caffeine taken in abundance (besides causing an increase of the reflex excitability and its consequences) makes the heart restless, and thereon in turn depend at least many mental disorders, and, *vice versa,* attacks of irregular action of the heart are caused by mental commotion. Therefore I hold it to be scientifically quite possible that at least very many cases of neurasthenia are intimately connected with the modern immoderate use of coffee and tea. And to this corresponds the further fact that there are the most neurasthenics in countries where the most coffee and tea is consumed, especially if the augmented ingestion of caffeine is accompanied by a reduced use of alcohol. Is it an accident that in North America there are the most abstainers from alcohol, that the same country

leads the world in the use of coffee and tea, and that there nervousness, neurasthenia, was "discovered," so to speak, by Beard about twenty-five years ago?[1] Or, to come to ourselves, is it accidental that in Munich neurasthenia is much less common than in the portions of Germany known for their love of coffee? Is it an accident that those districts in Germany in which, for pecuniary reasons, the people really consume less coffee than alcohol furnish much fewer nervous persons than the others in which the people are not overworked mentally (for example, most of the women of many towns, who by reason of their station, besides what has been described, have no cares and lead very much the same social life as many women of the world who are not nervous), in whom the preponderant use of caffeine is at once striking? Is all that accidental? That cannot well be assumed; there must be a connection.

We see therefore that the facts—the effects of caffeine on the one side and on the other the prevalence of the use of this substance in the districts concerned—make it scientifically, not

[1] It is hardly correct to say that Dr. Beard professed to have "discovered" neurasthenia. He did not even coin the word.—TRANSLATOR.

only possible, but very apparent, that the immoderate use of coffee and tea that is now so widespread has more or less connection with the modern diffusion of nervousness. And this indirect connection is heightened when an increased consumption of caffeine is accompanied by a reduced consumption of alcohol. All that is explained by the radical difference between the effects of alcohol and those of caffeine.

Since in the scientific part I shall have to deal most thoroughly with the effects of alcohol on the central nervous system, I shall here adduce only a few prominent facts, to give the reader a picture of the case. Coffee and tea, then, heighten the reflex excitability; alcohol reduces it. The former intensify the excitability of the perceptive, conceptive, and association apparatuses; alcohol, taken regularly and moderately, leaves it undisturbed, though, taken immoderately, it reduces it. Alcohol, taken in moderation, stimulates us, but the kind of stimulation is quite different from that of coffee and tea.

We shall see further on that alcohol arouses and stimulates all our inner mental personality. But neither caffeine nor the other con-

stituents of coffee and tea do that. They stimulate only the apparatuses of apperception, those of association as such, in short, those cerebral apparatuses whose action is directly mechanical. That such is not the stimulation of alcohol, that it has hardly anything to do with our stimulation as mental personalties, is evident from the fact that this caffeine stimulation of the cerebral apparatuses as such hardly affects our sentimental life; on the contrary, that suffers if this kind of stimulation is experienced too frequently and too intensely. In short, while alcoholic stimulation affects the entire inner personality (temperament, talents, and sentiments), and the merely perceptive apparatuses and their activity secondarily, stimulation with coffee does not operate upon the feelings, the temperament, or the talents, but only upon the external perceptive apparatuses as such, acting as a machine. Therefore the use of coffee favours rather the "mechanical mental activities," it is a drink for such activities as pre-eminently promote diligence; alcohol, on the other hand, favours the creative mental faculties that give rise to ideas of strong feelings and exertions of the will.[1]

[1]Naturally by "coffee" coffee beans, tropical coffee, must al-

From this comparison it will readily be seen that where the consumption of alcohol really exceeds that of caffeine conditions result that are naturally different from those that occur where the reverse is the case. Nervousness is only too intelligible; one will therefore readily understand the author's point of view, according to which it is always proper for more alcohol than caffeine to be taken daily, and this must not be reckoned in grammes, but according to the effect, and that everybody can readily test on himself. The moderate man soon knows whether or not he has taken too much of the one or the other. Naturally this rule requires great moderation in the use of coffee and tea, for the daily effect of the alcohol ought to exceed that of the caffeine. And since a moderate man restricts himself to moderation in the use of alcohol as a rule, he has need of all the greater discretion in the use of caffeine. The immoderate drinker of coffee and tea would have to take so much alcohol as might be beyond his means, apart from con-

ways be understood. The action of caffeine, as will be seen, affects the apparatuses of "external mental life". We shall recur farther on to this expression, which is short and very well understood by the laity, and contrast it with "internal mental stimulation."

siderations of health. The rule of life, "always more alcohol than caffeine," has the good quality of restricting the moderate man to decided moderation in the use of coffee and tea.

Summing up our conclusions, we may say, then: We do not by any means deny that nervousness and neurasthenia may occur without the abuse of coffee and tea (or without the use of these drinks while there is abstinence from alcohol). We stand, however, upon the assertion that, if the conditions of one's life or his bodily constitution incline him to nervousness, apart from exceptional cases, the immoderate use of coffee and tea (quite particularly if it much exceeds the concomitant use of alcohol, and certainly if it is accompanied by abstinence from alcohol) may be the sole cause of nervousness and commonly actually has that effect. It is therefore worth while to reflect if the modern haste, so often adduced as the cause of neurasthenia, is not frequently an effect of the immoderate consumption of caffeine upon those affected. Wherever the use of alcohol much exceeds that of coffee and tea, people are not subject to the modern haste. Among the "modern claims on nervous force" there are always two—one that

gives rise to them and one that results from them.

I think I have expressed myself clearly enough: It is not that nervousness is caused solely by caffeine, but only that the shockingly great modern increase in the number of the nervous is brought into connection with the present extraordinary increase in the consumption of caffeine. And if anybody thinks that this connection is not sufficient to explain the prevalence of nervousness, but would adduce all other possible causes, he surely cannot, if he has followed up the physiological and pharmacological actions of caffeine and alcohol, deny that the immoderate use of caffeine, in opposition to the use of alcohol and especially if alcohol is at the same time abstained from, is tolerably certain to occasion nervousness. Therefore every man should know the two important facts that alcohol reduces nervous irritability and caffeine (coffee and tea) increases it.

Practically, it does not follow that one must avoid coffee and tea altogether; that is not necessary, but he should return to the moderate use of coffee that prevailed in times when nervousness was not the extensive cause of

trouble that it is now. It is certainly not an accident that these times coincide with those in which the use of alcohol far exceeded that of caffeine. With every *demi-tasse* of strong coffee cognac or a good liqueur is needed, and with every cup of tea a little rum. Whoever is familiar with countries or circles accustomed to that practice—apart from the glass of wine or beer that is taken in addition with the principal meals—knows how comfortably the people live and how free they are from nervousness.

VI

FINAL DEDUCTIONS FROM THE MEDICAL PART

We have considered our subject from very different points of view, but have found not a single objection to the moderate and regular use of good alcoholic drinks. On the contrary, the material of the last chapter shows that our modern public use them more than those of all previous times. Since alcohol unburdens the interior of the body of blood, it alone, of all our articles of food and drink, counteracts all the causes which, not only dispose to nervousness, but lead directly to it unless we are careful.

PART II

PHYSICAL

I

GENERAL

We pointed out in the Introduction that it was particularly a scientific investigation of alcohol that we set down as something different from medical experience with the effects of the use of alcoholic drinks. Further, as we went over medical experience we adduced considerable material from the special study of alcohol, but only by way of exposition. It must therefore now be undertaken by itself. A field in many respects new will thus be made accessible to the reader. While hitherto we have been mainly concerned with the effects of alcoholic drinks of various composition, among them those of alcohol itself (a task in some respects incapable of performance), in the following it will be much more frequently alcohol itself, ethyl alcohol, that will be treated of. That is already an advance. We shall now deal, at least in great

part, with scientific trials and experiments which have a direct bearing on living organisms—plants, animals, and man. It is a method that in science is always rightly preferred to all others so far as it is practicable. It not only allows alcohol as such to be employed, but it has two further advantages, one of which is that the effects of moderate, even minute amounts of alcohol on living organisms may be ascertained. The second advantage is that thus, and thus only, can the influence of small quantities of alcohol on the various individual parts and organs of the system and their results be studied separately. In this way we may study the action of alcohol on gastric digestion, on the secretion of saliva, on the absorption of nutriment from the alimentary canal, on metabolism, on the disposition of albumin in the body, on the work of the muscles, on the temperature, on the heart, etc.

And if the matter is not so managed, there is, as we shall see farther on, in the consideration of the nervous system, no impairment of the fact that the experimental investigations of alcohol in question signify in their totality a notable advance in our knowledge. If medical experience furnishes no grounds for op-

posing a moderate use of alcohol, the public will be most interested in those effects of alcohol which are exerted on the healthy organism, and their exposition forms the object of the experimental investigation of alcohol physiologically and pharmacologically. So it is to-day, when disquisitions on the abuse of alcohol are more and more giving way to those on its use. In this new stage the legitimate interests of the public demand that our entire knowledge of the question be brought forward without reserve. Necessary, therefore, and not merely interesting, is the contribution of the following, since in their zeal to inform themselves people have long picked out this and that from the contents of scientific books and treatises, so that they have in their possession certain details while they lack the knowledge of their connection that is necessary to appreciate their full significance. The consequence is that such details have become catchwords and as such flit about unsteadily in the world.

What, then, must the public think of such statements as these: "Alcohol is a poison" or "Alcohol has only a paralysing effect"? The laity cannot possibly know that the words

poison and paralysis mean in science often only a little of the dreadful that is inherent in them according to the ordinary use of language, and never anything more. The public simply does not know that professional men have hardly ever subscribed to the hypothesis (for it was never anything else) of the effects of alcohol being only paralysing. And it is quite as ignorant of the fact that the overwhelming majority of our learned colleagues stand so little in dread of the poisonousness of alcohol that they keep on drinking their glass of wine in undisturbed serenity. In short, the public lacks all knowledge of the intimate connection, and consequently its uncertainty is all the greater, as it takes cognisance of the known and of the assumed, when it observes that, in spite of the sayings mentioned, old age is reached in health and capability for work while the accustomed glass of beer, wine, or liqueur is taken. It is unable to comprehend, therefore, where the " poison " and the " paralysis " are to be found. What is to follow ought to put an end to this state of uncertainty.

If we glance at the material that must be taken into account in the form of scientific

treatises, it is very large; in the last ten or twelve years only there have appeared about a hundred and twenty works that we must deal with. As regards the subjects of the experiments, they have been various animals and man. And it is quite justifiable to adduce experiments on animals, since so-called autosuggestion in the human subject may vitiate the result, and that of course cannot be the case with animals. On the other hand, it must be confessed that not all experiments on animals and their results can without criticism be held to apply to man. This is particularly true of studies of the effects of alcohol on the central nervous system. It is evident that we human beings differ principally from animals, not only in " phenomena," but, above all else, in our infinitely more developed mental life, as well as in the development, form, and size of the anatomical apparatuses subservient to mental life. We are at once reminded of the brain, which in proportion to the other parts of the central nervous system is not so large and so developed in any of the lower animals as in man. To this structural difference there corresponds, not only a psychophysiological distinction, giving rise by virtue of his highly

developed mental activities to an altogether peculiar nervous life in general in man, but also a pharmacological difference. That is to say: If a substance introduced into the body acts upon the central nervous system, and especially upon the brain (and this is decidedly the case with alcohol), the result is far different in man from what it is in the animal.

For example, the action of morphine on the dog is known to be different from its action on man, and still different on the frog; and, yet, in each instance the substance acts upon the brain and upon the spinal cord. The difference is dependent on the fact that the cerebral action of morphine is the feature of the picture wherever the brain predominates in size and activity. But where it does not, the action of morphine on the spinal cord assumes the ascendant. So it happens that this substance is a stupefying narcotic of the first rank for man, but for the frog a mere antispasmodic. Alcohol also acts specially on the brain, and particularly, as we shall see, on our inner mental life. Hence it is easy to understand that in this respect we cannot depend absolutely upon experiments on animals,

though they are quite indispensable in investigating the bodily effects of alcohol.

It is now self-evident that I am not offering the reader a mere "objective conglomeration of facts." That would not only be tedious for him and for me, throwing on him the work of thought which properly belongs to the author, but it would not be scientific. Even science is not made up of facts alone, but one of its most important functions is that of appreciating facts of quite various significance and of harmonising them. In what follows, we shall call the latter function into abundant play, since it alone can teach us what we must regard as peculiar in the effects of alcohol on man. That which will be presented to the reader is therefore the result of a critical elaboration of the material at hand, which, if not exclusively, will at least predominately constitute a special investigation of alcohol. These last words convey a limitation which must not be forgotten.

We have here to deal not only with facts scientifically established, but also with those that are the outcome of human experience in general; nay, the latter are of the greatest

value to us at points where, from the nature of the proposition, science does not furnish us with sufficient material, as, for instance, in the discussion of the effects of the regular and moderate use of alcohol on the nervous system. In this chapter more than in any other it will appear attractive and necessary to bring the facts of science and those of experience continually into relation with each other, in order to present a clear picture of the effects of alcohol, to check science in the light of experiment, and to explain experience with the aid of science. This might well be all that I should have to premise.

Three principal subjects of consideration are appropriate to what follows: 1. The position of alcohol in its relations to living organisms throughout all nature. 2. Alcohol as a substance oxidised in the body, as a nutrient and source of strength, and its influence on digestion. 3. The effects of alcohol on the circulatory organs and on those of the nervous system. In a supplementary way some further special points will be briefly discussed, but the summing up of our opinion of the alleged poisonous nature of alcohol will form the conclusion.

II

THE RELATION OF ALCOHOL TO LIVING ORGANISMS IN GENERAL

MANY a reader will perhaps be surprised to hear that there is here to be a discussion on the position of alcohol in animated nature in general, of its physiological and normal relations to different organisms. This astonishment is only natural, as the public has been somewhat strongly imbued with the opinion that alcohol as such is a body foreign to nature, created by the artfulness of man, and peculiar to him. The belief is very general that it was man who succeeded in introducing artificially this dangerous substance into poor innocent organisms, which, not being prepared for the encounter, naturally reacted most strongly with all their shrieking cells against this contact, as if they intended to show their disgust. Every drop of alcohol, accordingly,

could only act as a poison upon the natural organism. This organism seems to be depicted as a lamb upon a green meadow.

And, honestly, are there not many men who imagine this to be the condition? But the reality is so entirely different.

My irony, I hope, will be forgiven. It is a fact that a man weighing one hundred and forty pounds really believes that he is partially poisoning himself when by drinking a pint of beer he introduces into his body 0.05 gramme of alcohol to the pound of his weight. But the expert knows that for about thirty years alcohol has been found in the most normal animal organism, into which it was never introduced artificially by man.

The fact is also known to him that the formation of alcohol in normal metabolism of plants which we sometimes eat raw, plays an important rôle. He is also well aware that science will in the next ten years take up the question of whether such metabolism does not also occur in animals and in man. It can be comprehended how the expert may sometimes find it difficult to avoid being ironical.

To be sure, the amount of alcohol found in the normal organism has, except in certain

experiments, always been small, and there has never been observed a great amount of alcohol in the individual organs of the body, even in the state of highest intoxication. This will be shown by our investigations. Even there we experiment with an amount of alcohol very seldom met with in the life of a drunkard. Therefore it can be seen of how little import is the amount of alcohol in the organs of a judicious drinker.

Furthermore, this is readily intelligible, since an accumulation of alcohol in the organism cannot take place, because our cells are so constructed as to burn up the alcohol or make it available as a nutrient. Although we shall treat this question more fully later on, it is necessary to mention it here, in order that the reader may understand that the alcohol found in normal conditions can only be of the smallest amount, and the residue that escapes conversion very minute.

We shall now introduce the reader step by step to the conditions in question and show him the meaning to him in particular of a research which may have been so far unknown to him.

First, it is not true that living cells, of

which, as is well known, our organism consists, react upon every contact with alcohol as upon a poison.

Naturally strong or even absolute, that is 99 to 100 per cent., alcohol is very detrimental to them. But, like other substances, alcohol has the attribute of not injuring living cells under certain conditions. Distilled water, that is water in its purest state, is as harmful to living cells as absolute alcohol, that is, alcohol in its purest state; it ruins and kills the cells. Water becames innocuous when certain bodies are suspended in it, *i.e.,* salts in a certain given concentration.

Ordinary salt, indispensable to our organism in a 0.7 to 0.9 per cent. solution, will kill most living cells instantly, not only as a pure, *i.e.*, absolute, salt, but even in strong watery solutions.

Quite like these substances, to which could be added many more, alcohol behaves toward living cells when it is diluted. And this is usually the mode of its introduction. The cells absorb it very well in that condition, as can be seen, not only in certain mould or yeast fungi, which thrive in a medium containing a ten per cent. solution of alcohol, but also in cells

of higher animals. It has been found that cells of the ciliated epithelium of the air passages, isolated from the mucous membrane and transposed into a slightly alcoholised physiological salt solution remain alive much longer than in a non-alcoholic solution [7]. It has been observed that some warm-blooded animals, living in an atmosphere containing vapours of ninety-six per cent. alcohol, suffered severely, but some, again, showed in their tissues an extraordinary indifference to this abnormal condition of life [8]. Finally we should not only have to add to these experiments the essential parts of what we shall have to say in our discussion about the localisation of the influence of alcohol upon muscle, metabolism, digestion, the heart, etc., but also the fact that numberless men live very well with a judicious alcohol consumption. They are really nothing else than walking examples of the fact that alcohol, diluted enough, is not harmful to the living cell, the living organism.

That is a first principle which exists not at all by itself, without connection or without reason, but is third in the combination of two other principles about which there can be no dispute at the present. I refer to the fact that

the capability of forming alcohol is widely dispersed all over nature. To be added to this must be the other fact that therefore alcohol is found all through nature.

Even the layman knows that the industrial production of alcohol is really based upon the decomposition of sugar, or starches changed into sugar (in the end sugar only), through the living yeast fungus into carbonic acid gas and alcohol. This is the basis of spirit manufacture.

This was also for a long time the fundamental principle of the production of alcohol. It was the idea that this was a specific faculty of the living yeast fungus, which faculty disappeared with the death of the fungus. But this exposition has been regarded as quite untenable for a number of years.

First of all, the autocracy of yeast has disappeared as many other organisms have the faculty of producing alcohol from sugar. More about this farther on. Furthermore, we have known for years that living cells were not absolutely necessary for the production of alcohol. This can also be done by inanimate substances. But these substances have to be produced from living cells. There is,

therefore, a certain superiority in the living organisms because the chemical substances used for the formation of alcohol from sugar had been previously used for the building of living cells, and were chemically a part of their bodies. Such were especially the nuclei of the cells. They were the so-called nucleo-proteids. These were in the beginning essential to the formation of alcohol from sugar through subtances which were not of complicated composition of pulp or sap from cell material, but were well-defined and well-known chemical substances. These substances, previously found only in living organisms, characteristic of the living cells, were always the same, no matter if they were found in the yeast fungus, in peas, or in the ox's kidney [9].

Therefore we can say to-day that, although the production of alcohol may be widely distributed in nature, it has its limits, ending with the existence of living beings, because certain chemical substances, essential to living organisms, appear in nature only where there are living bodies.

It is a question if that will always be the case. Encouraged by certain examples, science will always try to produce artificially in

the retort substances which are to be found only in living beings. I am positive that science will succeed in this. And then we shall not have to use living organisms for the manufacture of alcohol.

Taking all this into consideration, the question will come up: If the capability of producing alcohol is so general, do we not find alcohol everywhere where living beings and sugar play a rôle? Science gives a straight affirmative answer for the demonstration of which we have enough examples.

We are positive about the vegetable kingdom as a whole. I have recently asked the opinion of two leading plant physiologists, and both have assured me that it is well known that plants produce alcohol.

I have also mentioned that there is hardly a doubt that alcohol exists in the normal organs of animals. It has been found for more than thirty years by many investigators in animals which had not received alcohol artificially. This statement is so well demonstrated that we find it mentioned for ten years in the text-books for beginners.

The problem, therefore, to be solved by science is at present, not to collect more ex-

amples which would prove the general existence of alcohol and the general capacity of living beings to produce alcohol, but to demonstrate the part which alcohol plays when it is found in organisms under normal conditions. This will be the task of science for the present and the coming times, at least so far as it concerns animals and men. We can speak of it with some certainty in reference to the vegetable kingdom. And the results observed in plants have encouraged scientists to make investigations on animals and men, although the difficulties are great.

The quantity of alcohol found in plants has been small but the investigation of the question of its origin has led to the discovery of important processes in metabolism. The scientists will not desist from searching until the importance of the phenomenon has been proved, although the amount of alcohol found normally in animals may be very minute.

In the following I shall try to give a report of the present conditions of these experiments. We have not progressed so far with animals as with plants, and we must therefore discuss these two kingdoms seperately. In both kingdoms it is metabolism that will make

our investigations easier. We may therefore introduce a few remarks about metabolism, which is the same for all living beings, plants and animals. This introduction will be the basis for our future discussion.

Everybody knows that plants and animals need nutriment, which they receive from the outside and elaborate internally. This elaboration we call metabolism of the living being, and it consists of a great number of single manifestations, especially of a chemical kind. In this metabolism not only are certain aliments derived from the outside and transformed but some are also deposited, because not only must power for the work of the organism be produced, but also loss of material, which living beings suffer constantly, must be compensated for. As in every chemical production, there happen here also waste and decomposition products which the body discards outside as not useful or of which it makes use in its own way.

The substances used up or formed in this elaboration are therefore of a great variety. They are physically solid, fluid, or gaseous; of the last kind, everybody knows oxygen and carbonic acid. These we mention especially because the part of metabolism called respiration turns upon these two substances. Respiration is for the physiologist nothing else than that part of the metabolism in which oxygen is used up and carbonic acid is produced. By respiration the public understands something else. Its conception of this process is derived from men and higher animals, and is thought to be chiefly the external

acts of inhaling and exhaling air, the motion of the thorax relative to these acts, etc. But science calls these proceedings, which can be seen only in the living beings mentioned, external respiration. They have nothing to do with the intimate nature of the phenomenon, but constitute only a kind of transportation, that of bringing the oxygen from the outside into the cells, and of forcing out the carbonic acid from the cells into the surrounding air.

I wish to remark that science calls respiration in plants and animals the action of metabolism in which carbonic acid is produced and oxygen is used up. In this sense the respiration of plants does not differ from that of animals. They, too, use up oxygen and produce carbonic acid, a fact which can be discerned during the night, or when the plants are in the dark, or in plants which do not possess chlorophyll. Plants with chlorophyll do not show this process in the daytime, on account of assimliation of chlorophyll and carbonic acid through the light, where carbonic acid is fixed and oxygen is liberated. But this has nothing to do with the respiration of plants.

The following are, therefore, facts common to all living beings: They all possess a metabolism, they all use in this metabolism oxygen and produce, besides other substances, carbonic acid, they all breathe, and with them all the main seat of these actions is the cell itself and its nearest surroundings. It does not matter if the living being is a microscopic one-celled being or a complex of cells forming a higher organism, such as plants, animals, or even men. These consist of organs, and each organ consists of cells. The important fact is that in looking for the seat of

metabolism, even in man, the final results are in the cells which form the single human organs. These cells, of which the organs of living beings are composed, use up oxygen and produce carbonic acid.

This is the first principle. Although if we examine the actions more minutely, we find that the taking in of oxygen and giving up of carbonic acid by the cells are nothing else but superficial acts.

The importance and real interest are to be found between the two poles which form the actions produced in the body of the cell, and through which the cell is made to take in oxygen and give up carbonic acid. These are the actions which form the intracellular respiration, the intracellular metabolism, the chemical processes in the interior of the cell. Not only would it be too difficult to describe these actions, but it would also lead us too far. The layman will understand the general idea.

The processes in the interior of the cell consist, first, in binding the oxygen introduced into the cell with other substances. This can be done in two ways. Either the substance remains, so to speak, as a unit, and then we have a combination richer in oxygen, which is used by the cell in some manner; or the substance is decomposed into several parts in combining with the oxygen, it is burned up, and heat and carbonic acid are produced.

There are other chemical actions in the cell besides these two mentioned. Certain substances may be formed in the cell which the oxygen will need for its combination. Certain substances will be necessary for burning up or combining with the oxygen, and these substances must have the property of easily forming such combinations. We know a

certain decomposition, *i.e.*, a breaking up of compound chemical bodies into simple ones which come now into close connection with the oxygen. They are either burned up or are transformed into other bodies containing more oxygen. This may happen to both products of the decomposition or to only one of them.

There happens much in the body of a cell of which we know only a few facts. The matter is not exhausted at all by what we have said. We know about the decomposition, the burning up, etc. These are processes in which oxygen is used up and heat and carbonic acid are liberated, they represent the action between the two poles of the taking up of oxygen and the giving up of carbonic acid by the cell. This constitutes in the greatest part, if not entirely, so-called intracellular metabolism and intracellular respiration. The reader will understand the kind of chemical action which is performed in the inside of the cell if we use these technical expressions in the following.

After these explanations we return to our theme and ask: What rôle do alcohol and its formation play in the life of plants? We can be short in our answer, as the facts are mostly well explained. Experiments have proved that the place of and occasion for the formation of alcohol in the normal metabolism of plants are the normal plant cells. We know that the alcohol is produced from the so-

called carbohydrates, the starches, or, as their final product, sugar.

The plant physiologist summarises these actions as follows: The plants form alcohol by the intracellular respiration through the carbohydrates; or, more explicitly, the normal plant cell produces, during its metabolism, alcohol from sugar. We may add here: Alcohol and carbonic acid, as in the decomposition of sugar by brewer's yeast.

The next question is: What becomes of the alcohol so produced? The answer is, that the cell acts directly upon this alcohol by a combination with oxygen. We do not mean that this action consists only in burning up. The alcohol, always in combination with oxygen or perhaps with other substances (the exact action has not yet been clearly demonstrated), forms intermediate products which are in some way used up by the cell.

We must not forget that the combination of substances with oxygen is made easier by the presence of certain factors which belong to the ferments, here called oxidation ferments, not only in plant cells, but in animal cells. The presence of these ferments has the property of inducing substances to combine with

oxygen, while without it they combine not at all or very slowly.

The further, I might say the natural, result of these conditions is that usually only residues of the alcohol are found in the intracellular working of the carbohydrates, those which have escaped consumption. These residues are small, not constant in quantity, and correspond to the amount of oxygen intake, according to the situation of the cell in the plant body. The alcohol is therefore mostly found in parts of plants which are situated in the very interior. Alcohol was demonstrated, for example, years ago, in the interior of large tree trunks (10). Alcohol has been found in larger quantities, produced by plants, when the following method has been observed: It stands to reason that plants will produce more alcohol if their consumption of alcohol can be retarded, if no oxygen is given to them, if they are placed in an atmosphere free from oxygen. This experiment has been carried out and a considerable amount of alcohol obtained. Peas, for example, have been placed to sprout in water which did not contain free oxygen (11). They sprouted there as well as if they had received air. They decomposed

their carbohydrates into carbonic acid gas and alcohol in great amount. At the end of the experiment 40 per cent. of their dry substance was thus reduced. It was possible to weigh the products with scales, and it was found that the peas formed as much carbonic acid as if they had sprouted in the open air. Furthermore, the proportion of the gas to the alcohol was the same as if the fungus of brewer's yeast had produced alcohol from carbohydrates.

Peas were allowed to sprout in a solution of sugar which did not contain free oxygen, and they changed not only their own starch, but also a part of the sugar solution into alcohol and carbonic acid. This experiment shows anew that the formation of alcohol from sugar in the vegetable kingdom does not depend upon the yeast fungus. It shows clearly that the whole action is related to the processes happening in the normal intracellular metabolism of plant cells, that is, the real marrow of plant life.

The final result is: The alcohol produced under normal conditions in plants originates from the decomposition of starch in the plant cell, under ordinary circumstances, that is,

with the presence of oxygen; the alcohol is consumed, and what we see is only a residue. By cutting off the oxygen we hinder the further elaboration of the alcohol but not the decomposition of starch. We then have the direct products of the division, that is the alcohol, in larger quantities.

That is all we have to say here. It is enough to understand the rôle of alcohol in the plant cell, and it is not without interest for practical life. Many people think they are never taking in a drop of alcohol if they eat plenty of raw fruit and berries, and if they drink the juice of fruits or berries diluted with water. From what we have said it will be seen that this idea is entirely illusive. There always will be alcohol, even if it is only in small quantities, if the fruit or fruit juice is not used after a prolonged cooking. This has been demonstrated by the experiments of a chemist whose reports appeared in the newspapers about a year ago. We must take into consideration not only fungi and bacteria which by accident were added to the solution (this is not the standpoint of science any longer), but also the ability of plants and parts of plants to produce alcohol under certain conditions from sugar.

It was only natural, then, to see whether there were similar conditions in animals, whether in them also the alcohol which was found by the investigators in the organs and tissues originated from the splitting up of starch, and to try whether there could not be created experimental conditions similar to those in the experiments with peas, which would prove the formation of alcohol from carbohydrates. This method was adopted by scientists, although with doubtful results.

We have to-day not only one, but a series of investigations in which animal organs or a powder made from them have produced alcohol from starch. But there are also experiments which have failed to show this. We have experiments where the amount of alcohol was increased if the tissue performed respiration in an atmosphere free from oxygen, as with the peas, and again others which were negative.

The discussion is very animated, as the possibility that he who abstains wholly from alcohol continually produces alcohol in his carbohydrate metabolism would entirely change our ideas about alcohol.

I emphasise the fact that this question has not yet been decided. But, I also add, neither

pro nor con. We must not forget that there are many points in favor of the idea that the metabolism of carbohydrates in man is partly a division of the starch into alcohol and carbonic acid, where the alcohol is immediately burnt or otherwise used up. But it is not approved by all investigators. And this must be specially noted, particularly in a book written for the general public. There are many opponents to this idea. This is one side of the controversy. It must be stated on the other side that it is not yet proved that the metabolism of carbohydrates does not produce alcohol. The future will bring the decision, which does not question the formation of alcohol in animal organisms—that is proved,—but the importance which is to be attributed to this alcohol. Neither is it a question of whether the alcohol originates from the carbohydrates or not, as positive proofs cannot be denied, and there should be to-day unanimity of opinion on this subject. The question to be decided is that of whether the alcohol is an unimportant accidental by-product of carbohydrate metabolism in men and animals, or whether it is a residue of a primary product of our metabolism.

Although I say we do not yet know anything positive, the reader, even if he is a layman, will be very much interested. The point of view is entirely new. On the one side, alcohol is called every day with more emphasis a poison. On the other side science is investigating whether this poison is not an important intermediate product in the normal metabolism of the carbohydrates of man and animals. It is sufficiently shown that science in investigating this question does not concern itself with abstinence from alcohol.

There is another important point. It is this: There is nothing that can be said against the formation of alcohol in the normal metabolism of carbohydrates in man, but there are enough facts which speak in favour of it. I shall explain this: We have stated that the question so far is undecided; we must wait until science gives a positive opinion in reference to such comparatively new experiments with such diametrically opposite results.

There will be, besides the experimental demonstration of a contention, a scientific decision which is of no less, but of even greater importance. That is the decision as to

whether the assertion can be accepted or not, according to the known, and not opposed scientific facts which refer to that branch of science which is here in question.

If we apply this dictum to our question it means: Is it possible, according to our known and not opposed facts which refer to alcohol and carbohydrate conditions, that we constantly produce alcohol in our carbohydrate metabolism and absorb it (even if we do not drink alcohol as such)? This question must be answered in the affirmative. There are no reasons why such a production of alcohol in man is impossible. There are reasons which make such a mode of production appear very possible.

If we take it for granted that the carbohydrates in their metabolism are, at least partly, decomposed into alcohol and carbonic acid, and that the alcohol would be immediately absorbed, we shall then have such conditions as really exist to-day. We shall find only very small quantities of alcohol in our organism. The alcohol produced will be immediately burned up or absorbed. That must be the case, as our body very easily burns up

relatively great quantities of artificially introduced alcohol. We should not observe any great effect of the produced alcohol upon the brain, for example, as the nervous system is not the main seat of the elaboration of the carbohydrates. The alcohol would be formed and disappear at the site of its formation, with the exception of a minimal residue in the place of its absorption. I do not know how any one could become inebriated by excess of carbohydrates. The result would be a very weak one upon the organs, and such really is the effect, as we shall see later, produced by eating sugar. Furthermore, we could detect only with difficulty, as is really the case, the alcohol in greater quantity which appears in metabolism only as an intermediate product and is immediately absorbed. The experiments are conducted in investigating this question with much more difficulty than in plants. On the one side, the animal tissues which are to be used absorb much easier and are much easier destroyed than those of plants. On the other side they also have such a great capability of oxidation, that is, a power of further digesting the alcohol produced, that the keeping out of oxygen would not amount to anything. These

tissues possess a reserve of oxygen in the form of chemical combinations from which they can easily draw. Thirdly, it is necessary to exclude the bacteria in such combinations. If that is impossible, there will be formed a great amount of organic acid which will destroy the entire phenomenon; if it is possible, the normal efficiency of the animal tissue will be suspended in a great part with the killing of bacteria.

Why should the normal alcohol be a production *per se* and the normal distribution of alcohol in normal metabolism of man and animal an impossibility? What can be said against it? I do not know of any scientific reason against it.

We may now ask, What are the absolutely undisputable facts which show the intimate relation between carbohydrate metabolism in man and animals and the known production of alcohol from sugar?

Three facts may be stated. We shall see in the next chapter not only that alcohol is nourishing, but that the starches, therefore also the carbohydrates, of our food, can be exchanged for a certain amount of alcohol without disturbing the equilibrium of our

metabolism. In a few days the cells of our organs become accustomed to this change. This is possible only if our organism, that is the cells, are so constructed as to assimilate alcohol. This would be the case if we formed and assimilated alcohol in the metabolism of carbohydrates.

There is a certain parallel between the capability of the sugars to form alcohol and their capability to be used in human metabolism. The sugars which we eat are either simple or compound. To the first class belong grape and fruit sugar, to the second cane, beet, milk, and malt sugar. If, for example, yeast is to form alcohol from sugar, the principal condition is that this sugar shall be simple [12]. If the yeast is given a compound sugar, it will first decompose the compound sugar before it can form alcohol. Our yeast fungi can split up cane sugar, for example; they can therefore produce with it alcohol; they decompose it, and form alcohol from the simple sugar so liberated. Yeast cannot decompose milk sugar; it can therefore not produce alcohol from it. But other living organisms exist which can decompose milk sugar. These, but these alone, can produce alcohol from milk sugar;

that is, because they can decompose the compound sugar, they can form alcohol from the simple sugar so produced.

If the sugar is absorbed in our metabolism, and the starches must more or less be used in this form, the sugar must be simple [12].

Beet or milk sugar cannot be used in our body as nourishment if it is not decomposed, just as it cannot be changed into alcohol and carbonic acid by living organs if it is not decomposed.

The decomposition of compound sugar and starch takes place mostly in our digestive canal. If I eat them, they will be decomposed and used up as nourishment. If I do not eat them but inject them hypodermically in watery solution, many of them will not be decomposed. They have not passed through the digestive canal (mouth, stomach, intestines), they therefore reach the cells unchanged. They are then not nourishing. Our cells do nothing with them. Our body expels them as entirely valueless starch and sugar through the kidneys. Not a gramme could be used.

If the question should be about starch and sugar which can be decomposed in the tissues

of the body, which would not need for their division to pass through stomach and intestines, then they could be used by the body without being taken as food, but as a hypodermic injection in solution. Simple sugars are nourishing, taken by the mouth or hypodermically (12).

The principal condition for using carbohydrates as nourishment is therefore more or less the same as the principal condition for the formation of alcohol from them. This is the second and a very important point.

The starches, the carbohydrates, have alone, among all nutrients, an attribute which reminds us much of alcohol. They have alone, according to our present knowledge, the important attribute, not only of nourishing, but also of influencing the organs of circulation, perhaps even the central nervous system [13].

These specific effects are not so much developed as in alcohol, but they exist. We shall mention this later. We wish to call attention to the fact that this specific effect has so far only been observed in two nutrients, starch and alcohol. Experiments have been made with albumin and fat, but they were found to nourish only.

These are the most important facts which we can mention. We could add more. There have been found, for example, certain organic acids which appear on the production of alcohol by yeast, and which have nothing to do with the accidental influence of adventitious bacteria according to the latest experiments [14]. They have always been found when the products of sugar metabolism by animal organs have been investigated. The exuberant increase of these in comparison with the production of alcohol appears in phenomena apparently so opposed that I had to ask myself in studying the physiological question whether I was not reading a report of an unsuccessful spirit manufactory, instead of studying the products of sugar assimilation.

I wish to repeat that alcohol as a nutrient can take the place of carbohydrates, that the use made of the carbohydrates in metabolism is nearly the same as the production of alcohol from carbohydrates, and that the use of carbohydrates means not only the supply of nourishment, but also the supply of material which gives a specific result. From this I think we can deduce that the opinion that our metabolism of carbohydrates takes place together

with the formation and assimilation of alcohol is not the fastastic dream of a scholar, but has a real basis of physiological facts, as mentioned by us. This circumstance will force a real skeptic to admit the possibility that the assimilation of starch in our metabolism is more closely related with the known production of alcohol from sugar than many a man of to-day imagines.

We have come to the end of the second chapter. We have seen that it is not necessary that organisms should become acquainted with alcohol by its ingestion. Alcohol is an old acquaintance of the plant and animal cells, and certainly of human cells. It appears often, even constantly, in these living beings when it has never been introduced artificially.

Tracing the origin and the importance of alcohol found in and produced by living beings (from the plant to man), one has met, not with morbid curiosities, but with normal metabolism, which takes place in the cell, that is intracellular, in the marrow of life.

The production of alcohol from carbohydrates is of importance in the intracellular respiration of plants. The same question has not been definitely settled with regard to ani-

mals and man. It is positively known that the alcohol found there came from the carbohydrates. It is probable that it is excreted in the intracellular respiration. But the question is not decided and scientists are not unanimous as to whether the alcohol is an unimportant by-product of the carbohydrates metabolism or an important intermediate product of intracellular metabolism. Some scholars deny the first assumption, some accept it, and the latter are supported by physiology, which gives many reasons for the connection between alcohol and carbohydrate metabolism, and none against it.[1]

[1] Maignan, of France, supports by his latest investigations the thesis of alcohol combination and assimilation in normal tissue, *i. e.*, in the muscles of mammals. These experiments speak, furthermore, against the theory that animal alcohol originates through fermentation in the intestines (compare *Zentralblatt für Physiologie*, August 26, 1905).

III

ALCOHOL AS A NUTRIENT AND A SOURCE OF STRENGTH

In the preceding chapter we spoke of the alcohol produced in normal living beings. In the following we shall treat of the alcohol which we drink, which is introduced into the organism from the outside.

This is an entirely different matter although it is related to the preceding question. The principal point of difference is that the alcohol produced normally in living higher organisms is immediately, in greatest proportion, assimilated in the place of origin, and only a small residue leaves this situation, the body of the organ cells. It operates as alcohol circulating free in the organism only in very small quantities. On the contrary, the alcohol which is introduced into the body from the outside will be partly assimilated by the same

cells, but it circulates and influences many organs, until it reaches the proper place of assimilation.

That is the main point of difference. It is easy to understand the connection between the two questions. If we review what we have said, we shall see that one point was proved years ago, that our cells are by nature accustomed to alcohol. And that if of great importance for the comprehension of the following. If alcohol is found in the organism, if our cells are used to it, even in small quantities, only then can it be understood that they are capable of assimilating alcohol introduced artificially, if it comes to them in not too great quantities.

Our reader will now comprehend if I state that the physiologists were not astonished to hear that alcohol was nourishing. This is the main idea in this chief chapter. It adds to the explanations of the ideas of the previous chapter. We will now continue with the discussion of the second chief topic, that of alcohol as a nutrient and source of strength.

We will proceed step by step and follow the way taken by alcohol when we drink it. It is taken into the mouth, it is swallowed, and

it reaches the stomach, from which it is taken up by the juices, which carry it through the body.

Alcohol therefore passes through the so-called organs of digestion, wherefore the first question is: Does it influence digestion and the digestive organs, and in what way? We answer the first part of the question in the affirmative and say that the influence is beneficial if the amount of alcohol is moderate. Alcohol favours the secretion of saliva and the gastric juice. This secretion, larger than usual, consists of a good, normal, well digesting juice.

As we proceed, we shall speak of the special manner in which alcohol produces this favourable result. The influence of the nerves is very important. We have arrived under good auspices at the small intestines. From there it is impossible to show the influence of alcohol either pro or con.

Alcohol does not influence intestinal digestion or the absorption of food from the intestines by the juices of the body. They act as if no alcohol had been taken. The explanation is very easy and to the point. The alcohol swallowed is absorbed by the juices in the

stomach (this is not the case with water, which the stomach hardly absorbs) [15]. There is therefore hardly any alcohol left in the nutrient material which reaches the intestines. Where there is no alcohol it can have no influence. Therefore alcohol can have no influence on digestion below the stomach. All this is proved by experiments and therefore we need not dwell on it.

Absorbed from the stomach in the juices the substance is carried through the entire body. What happens to it? Answer: The largest proportion is turned to account in the organs of the body with the help of oxygen, and used as a nutrient, a small part is excreted by other parts of the body, especially by the lungs. We have to stop here for a moment, as this fact is often used against alcohol, because many allege that "the body endeavours to throw off substances which it recognises as harmful." Is this such a throwing off by the organism? Certainly not!

In reality there is no such "effort to throw off" in the body. The body excretes not only poisonous but also innocent substances which have been introduced, and also very often carefully accumulates pronounced poisons.

The exclusion of a substance by the body is no proof of the poisonous properties of that substance. Otherwise cane, beet, or milk sugar would seem to be much stronger poisons than alcohol as they are excreted by the kidneys when injected hypodermically. The same is to be said of water and common salt. We can now investigate the question of why only a small part of the alcohol is excreted. I think the reasons are very plain.

Quite a time passes before the alcohol circulating with the blood through the body is taken up by the organs. If, now, this volatile, easily vapourisable substance passes with the blood through organs which are in intimate connection with the external air, such as the surface of the alveoli of the lungs, it is only natural that some of it should be vapourised. In such a manner alcohol escapes with the exhaled air.

It is further natural that alcohol under certain circumstances should be excreted by the kidneys. Much blood serum and other ingredients of the blood are excreted, and it is not to be wondered at if a part of the alcohol escapes with it. It is not much. The greatest amount is lost by the lungs. It is a small

fraction of the alcohol ingested, never so much that it could be discerned by smell in the air exhaled from the lungs. The stuff we sometimes smell consists of other substances taken in with alcohol and deposited in the mouth and fauces [16] (fusel oil in whiskey, ether in wine). If pure alcohol is taken, and the mouth and fauces are well cleansed, there will be no so-called alcohol aroma of the breath.

There is, therefore, absolutely no reason to believe in any defensive action of the body. The process is very simple. On account of the volatility of the alcohol taken and absorbed, carried by the blood to all parts of the body, a small part is lost. The lion's share remains in the body and is used by it as nourishment.

Alcohol as a nutrient.—I really think that the public sometimes takes the capability of alcohol to act as a foodstuff as a new discovery, as the latest branch on the tree of science. But that would be a great error. For a number of years we have known that alcohol does nourish. We are only limited as to the quantity to be taken, as the alcohol not only nourishes but also acts specifically upon the nervous system. It seems as if this property

had been forgotten, until about ten years ago it was again proved by scholars of all nations.

We therefore discuss in the following a question which has been known for quite a long time. The latest investigations are about eight or ten years old, and they have shown us that alcohol is not only a nutrient, but a good one besides. This fact also is proved by all nations. The question of its significance will have to be discussed.

It may be said, in the first place, that the alcohol in the body will be burned up, oxidised, *i.e.*, elaborated with the help of oxygen. That is something, but not enough.

Indeed, our body burns up alcohol, and we receive from it warmth and living strength. The saying of the people, "Alcohol gives warmth and strength," is therefore no idle talk. But this is not the only definitive conclusion. We shall have the main point if we add to this statement the fact that alcohol protects albumin from disintegration in our metabolism.

Alcohol economises albumin. We note this statement quite often in the daily press. But we must explain it somewhat. What does it mean, "alcohol economises albumin"? We

must understand this well, because the simple statement does not interest us. We eat a little more albumin if we do not drink alcohol, and everything will then be all right. Why do we lay so much emphasis on this fact?

But this question is not meant as the public usually understands it. It is not a question about the quantity of albumin which we can lower (although this is important for the poorer people, who have in alcohol a nutrient and a source of enjoyment), but about the importance it plays in the economy of the cell. It is a characteristic action of the real organic nutrients that they protect the albumin against decomposition by themselves splitting up in the metabolism. They take the place of the albumin, that by their decomposition the body may perform its work, which it would do otherwise with the nutrient *par excellence,* albumin.

We now look upon this question in the right sense. But to understand it well we must remember that albumin, starchy substances (carbohydrates, to which belong the sugars), and fat are the three important nutrients. If we consider albumin and the carbohydrates, we shall find an interesting relationship

between these two substances: If our body has enough carbohydrates, it will save the albumin in metabolism.

But this does not go so far as to mean that we should not need albumin at all if we consumed enough carbohydrates. A certain assimilation of albumin takes place under all circumstances. There are certain functions of our body which can be performed only with the aid of albumin. But only up to a certain point is the replacement of albumin by carbohydrates possible in metabolism, and it is true only provided we take up a fixed amount of mixed nutrients. And that means that the carbohydrates, by their assimilation in metabolism, make possible certain functions of the body which without them albumin would have to attend to. This is an important attribute, which the fats possess also. These, too, help by their metabolism to perform actions which without them (and the carbohydrates) albumin by its assimilation would have to attend to. The compensation by means of the fats is not so far reaching as that by means of starch.

We can say: There are actions of our organism which can be made possible only by al-

bumin assimilation. Besides these, there are other functions which the body prefers to perform with the aid of fat and carbohydrates, if these are at its service; if not, it is forced to use albumin. That is, if the body is in good condition in consequence of a sensible mixture of nutrients, it prefers to use fat and carbohydrates and save albumin.

The same was the case in the experiments on metabolism with alcohol. If there was a certain quantity of alcohol instead of carbohydrates, the body used alcohol for the functions for which formerly it had used carbohydrates. The final result was the same, in spite of the change of starch by means of alcohol. The organism saved albumin in about the same quantity.

We understand now the importance of knowing whether a certain substance saves albumin or not, and why we call a real organic nutrient a substance which saves albumin in the same quantity as is done by carbohydrates and fat, the undeniable nutrients. That is what we expect from a nutrient. Alcohol answers this requirement, as proved by many experiments on the healthy and the sick.

We know now the importance of alcohol as

a nutrient. We wish to add a few words about the degree of this nourishing power, which is very satisfactory.

To compare the degree of nourishing power of substances, we cannot compare 100 grammes of fat, for example, with 100 grammes of sugar, we must consume a certain amount of fat the calory of which corresponds to that of a certain amount of sugar.[1] The calories—I can only mention this here—of different substances are different, but they decide the power of a nutrient. The experiments are conducted in such a manner that a given amount of fat with a given calory is replaced in the nutrient by a given amount of sugar which has a different weight from that of the fat but possesses the same calorific power. We observe the amount of albumin saved, etc.

We proceed in the same manner when examining the nutrient power of alcohol. We do not exchange, for example, 100 grammes of sugar for 100 grammes of alcohol, but 100 grammes of sugar of the food for so many

[1] That is, an amount of fat which, when decomposed into water and carbonic acid by combustion, produces as much heat as an equivalent of sugar when this is decomposed by combustion into water and carbonic acid.

grammes of alcohol as would possess the same calorific power as 100 grammes of sugar. We do not compare substances of the same weight, but of isodynamic nutrient strength, as it is called in science.

The experiments show that, in proportion to its calorific power, alcohol nourishes as much as carbohydrates and fat. For example, if we use so many grammes of alcohol that their calorific power is equal to that of 100 grammes of carbohydrates, the amount of alcohol saves as much albumin, performs as many duties of the organism, as 100 grammes of carbohydrates would do. The amount of alcohol necessary for such a performance is not extraordinarily high: 100 grammes of sugar will be replaced by 170 c.c. of brandy, possessing a strength of 35 per cent. of alcohol [17]. The alcohol performs as much as we could expect, with one restriction. This I shall state.

We shall see in the third part not only that alcohol is a nutrient, but that it possesses also specific properties which act upon the organs, especially upon the nervous system. These we have to take into consideration, even if we use the alcohol as a nutrient, as is done very prop-

erly with sick people and under certain conditions of life. Thus, we must not give too much alcohol, otherwise the effect of alcohol will be so strong upon the central nervous system that it will destroy the value of the substance as a nutrient.

If we therefore introduce alcohol into the metabolism we must draw a high mark, and that is about 60 grammes of alcohol for a day. The exact amount cannot be stated, as it varies according to the condition of life of the individual. The mark must be low for a small amount of muscle work (30 grammes of alcohol a day). The greater the amount of muscle work the higher the amount of alcohol. In the form of good brandy, 100 grammes of alcohol a day was not harmful to the soldiers during the campaign of the severe winter of 1870 to '71; the body used up the alcohol directly as a nutrient in great quantities on account of the low temperature and the great hardships. These hardships were sometimes very great, and the introduction of other nutrient substances was not satisfactory. Alcohol therefore was of great help as a nutrient. If one thinks that alcohol is detestable as a nutrient because it

influences the central nervous system, one makes a great mistake.

We now recapitulate what was said about the value of alcohol. We use alcohol with good success in sickness. There it is of great importance because it surpasses nearly all nutrients on account of its easy absorption, for example, in a diabetic, taking the place of carbohydrates. It represents under certain conditions of life, as in winter, a concentrated, easily transported and preserved, and readily absorbed nutrient, not giving rise to thirst (in contrast to sugar), which warms and nourishes. The fact that alcohol nourishes is of importance for the healthy man living under healthy conditions. I shall explain this more minutely.

First, it is positive that men do not in the least need alcohol as a nutrient if they are always able to procure enough nutrient material, but such men only. They do not take alcohol for a nutrient, but to feel the peculiar specific influence which alcohol produces upon the central nervous system, as will be shown in the next chapter. That this specific influence of alcohol can act so moderately and well is made possible by the small residue of the alco-

hol which is not immediately used as a nutrient. The fact that alcohol is immediately assimilated in the body as a nutrient acts as a safety-valve which restrains the power of the alcohol upon the nervous system in reference to its strength and duration of action. I know very well that I produce a certain effect upon my nerves when I drink a few glasses of wine. (That is the reason why I drink it.) But I also know that this effect will not be too strong or too prolonged, because the alcohol which I consume in the wine will be burnt up, partly immediately and partly after a while. The fact that alcohol nourishes, is destroyed in the metabolism, and disappears acts as a safety-valve.

Second, this fact gains in importance because alcohol can under certain circumstances assist overnutrition as a food. I refer to the medical part of this book, in which we have discussed these matters. The nourishing property of alcohol plays a rôle which is different in the different conditions and spheres of life.

These facts and their importance have been appreciated. We have to discuss one more point, and that is the kind of service performed by alcohol. This is coincident with the place of its absorption into the body of the consumer.

Where and for what do human beings use alcohol? We can answer this question satisfactorily to-day. We know very well (why should I therefore hesitate to say it?) that the alcohol is used especially in work done by the muscles. It becomes the source of our muscular power.

Again there is a parallelism with the carbohydrates. These, too, are the chief sources of muscular power, so long as they are present in sufficient quantity. This is another point which favours the connection of the absorption of carbohydrates in the body with the production of alcohol from carbohydrates. We still find more points which endorse our opinion about this connection expressed in the preceding chapter.

It is peculiar that the investigators were from the beginning led to the muscles and their work when they searched for the importance of alcohol in the organism. I remark emphatically that this is peculiar, but it was no accident.

This is based upon general experience. Every man who is not used to alcohol can understand (I have proved it often on myself) that a quantity of alcohol which under or-

dinary circumstances would go to his head will show no effect, or hardly any, if he takes it in connection with an extraordinary amount of muscular work, for example immediately after a great effort in sport, during a long march, etc. We therefore come to the conclusion that this substance will be used up or disappear in us much quicker when we do some muscular work at the same time.

But all other observations in the physiology of alcohol lead the investigator with absolutely correct logic to the fact that the muscles are the seat of the absorption of alcohol. To this we may add that we have experiments, performed on animals, which show that the muscles can absorb immense quantities of alcohol. Therefore it does not mean much today if certain experiments made on man have not led to brilliant results.

The conditions are these: The good influence of alcohol upon the work of the muscles can be shown in experiments on man. Where the collective ends, we must refer to individuality. It has been found that alcohol produces this effect under certain first conditions, but not under certain second ones; on the other hand, there were experiments which had good re-

sults with the second condition, but not with the first. Sometimes a good result was immediately changed to a poor one.

There are probably two reasons for these irregularities. These experiments were not purely muscle experiments; a chain of incidents could be seen: psychic, nervous, and finally muscular processes. We could not decide upon the importance of the muscular. Furthermore, custom, auto-suggestion, and a third factor, which will be spoken of later, play an important rôle as sequelæ to the facts stated. This third factor is the psychic excitability produced by the mistaken use of alcohol, which diminishes man's energy for actions performed by him as a machine. To this class belong several kinds of sport and the muscle experiments. It is hard and tiresome for man to act as a machine if he has to overcome psychic excitation. He must overcome this psychic condition, which prevents him from acting as a machine. The muscle itself has nothing to do with it.

All this is not present in experiments on animals. There the experiment can be conducted in such a manner that muscle, and muscle alone, is set in action. To the muscle

is carried the alcohol in the blood which flows through the vessels. Here we have arrived at clear results which show that the muscle under a medium amount of alcohol performs more work and tires later. A large amount of alcohol is detrimental to its efficient action.

These experiments, furthermore, have shown that the good influence of a medium amount of alcohol acts upon the substance of the muscle cells, not upon indirect media, for example, not upon the terminals of the muscle nerves. This shows that alcohol is a source of strength for the performance of the cells of the muscles, and that it is used as a nutrient by the working muscle [18].

What, now, is meant by a medium amount of alcohol in figures? Answer: A large amount, so large that I hesitate to mention it. If I estimate the amount of alcohol which still has a favourable influence, I find that the proportion is 560 c.c. of absolute alcohol for a man weighing 140 pounds, or about 2.75 pints of brandy containing 35 per cent. of alcohol.

That is a toleration of the muscle protoplasm (of this we are speaking here) toward the alcohol, which we find only in the most favourable nutrients.

This concludes the second chapter of our investigations.

To summarise briefly what we have found out about the taking up of a medium amount of alcohol, we can say: That amount of alcohol which, if it influences digestion at all, affects it favourably is absorbed easily by the body and used as a nutrient with the exception of a small loss. It performs the same duty as is done especially by the carbohydrates, *i.e.*, it produces heat, as they do, and is a source of strength for the labour of the muscles.

IV

ALCOHOL AS A LUXURY

In our last chapter we showed that there was a difference between the alcohol produced in the organism and the alcohol artificially introduced. The difference was that the first was almost entirely absorbed at the place of its origin and appeared free in very small quantity only. The other, if it was absorbed into the blood, took quite a time before being taken up by the organs of elaboration; this alcohol had therefore time to influence as undecomposed alcohol different organs of the body.

We, therefore, must take into consideration the specific action of the alcohol imbibed, apart from its nutrient effect, more than that of the alcohol formed in the body. The obnoxious consequences of the immoderate use of alcohol, the abuse of alcohol, rest upon these points, but so also do the favourable results.

Not seldom nowadays do we find the idea expressed, as if it were a fact, that alcohol exerts prominently a specific influence upon the organs. But that is a peculiar idea. We must not only take in a nutrient, but also an acceptable article; otherwise our health would be absolutely ruined. This has been well known scientifically and practically for a number of decades. The neglect of the fact has had serious consequences. Luxuries are always substances which have a specific influence upon the organs. In this sense we shall use the expression luxury. The reader must understand that the meaning of luxury, as superfluous matter, does not come into consideration. Luxuries do not mean an extravagant indulgence, they are necessary as nutrients.

These luxuries differ according to the people. Not every man requires the same luxury. But if he has not a certain one, he uses another. All nations of the earth possess substances which have an influence similar to that of alcohol. Among these alcohol is the mildest and least pernicious.

The fact, therefore, that alcohol not only nourishes but has a specific influence upon the

central nervous system, *i.e.*, is a luxury, furthermore, that alcohol is therefore used by men and even sometimes abused, does not prove one iota against the use of alcohol, taken moderately. All these facts are the same for all classes of luxuries which are necessary for our health.

A substance should be avoided if, even in small quantities, it has not a good, but a detrimental, influence upon the organs. Such a substance is not a luxury, but a poison.

Alcohol does not exercise a noxious influence upon the organs, when taken in rational quantities, and there are only a few specific substances which have an influence similar to that usefulness as alcohol when taken in a sensible quantity. We shall therefore treat in the following of alcohol, not as a poison, but as a luxury, if we have to speak of the specific influence of alcohol upon the organs.

The question of how a substance can at the same time be a nutrient and a luxury is easily answered. We have seen that the alcohol is not at once completely used up in our body, but that it takes a certain time. During this time the alcohol circulates with the blood in our body, and comes as undecomposed alcohol

in contact with the organs, upon which only in that form can it have a specific influence. Two circumstances regulate the duration and degree of this influence of alcohol, which we can regulate according to our own judgment. The two circumstances are the quantity of alcohol taken and the extent of the demand made upon our metabolism, or, in other words, the amount of muscular work to be performed and that of the heat to be produced, together with the amount of the other nutrients with which the alcohol co-operates.

The more muscular work I perform, the cooler my environments are, and the less I eat, especially of carbohydrates and fat, the more alcohol can I drink without producing a severe influence upon the nerves, as the alcohol taken as a nutrient will be burned up and more quickly absorbed in my body. The less muscular work I perform, the hotter my environments are, the more I eat, especially of carbohydrates and fat, the more severe and of longer duration is the influence of the undecomposed alcohol upon the central nervous system.

Thanks to these conditions, every man can regulate the specific influence of alcohol so

that it acts beneficially and usefully upon his body. And these conditions have, in practical life, almost always regulated the whole mode of alcohol drinking.

It is known that the people of the south, who do less muscular labour, drink less alcohol than the people of the north, who perform much muscular work. This is certainly no merit of the southerners, but everybody lives according to his conditions.

Alcohol is a nutrient and a luxury in one substance. This fact is looked upon as unique, as some extraordinary principle, and is taken as something dismal. But there is no reason for this. Alcohol is in principle not the only nutrient which has a double nature. It is the same with the carbohydrates, one of the three series of organic nutrients absolutely necessary to men. Again there is a fundamental relationship between the carbohydrates and alcohol. I shall now rather more fully explain this circumstance, which I have mentioned before, in order that the reader may understand it.

It is only a short time ago that it was demonstrated that the carbohydrates were not only nutrients, but substances, as stated by one

of the physiologists, "which acted upon the functional condition of the organism" [19]. That is, they not only act as a nutrient, but exercise a certain specific influence upon the organs. In principle it is the same as with alcohol.

In this comparison between carbohydrates and alcohol, the latter must not be used as the drunkard does it. In him we have to deal with abnormal phenomena under all possible conditions: The body is permanently flooded with alcohol, so that it is impossible for it to be disposed of. Besides the alcohol, there are other substances which add to the strong influence of alcohol. These substances are partly taken up with the alcohol, such as the fusel oil, and they are partly formed from the alcohol or with the help of it in the body of the drunkard, whose metabolism has already been disturbed. The whole work of investigating alcohol has therefore hardly been at all advanced by the study of the drunkard, in the same manner as diabetes has as yet done nothing to clear up the effects of carbohydrates and their decomposition in the normal organism. Here, too, the results are not only a satisfactory burning up of the carbohydrates in the body or an inun-

dation of the body with sugar, but the formation of abnormal products in the conflagration.

If we wish to compare carbohydrates and alcohol, we have to study men who ingest the carbohydrates normally and men who do the same with alcohol, healthy, sensible consumers of alcohol. On imbibing alcohol, certain effects are produced upon the nervous system, the organs of circulation, etc., which are alcohol influences. There are also certain influences of the carbohydrates upon the organs of circulation and the central nervous system which are peculiar to the carbohydrates and have nothing to do with the nutrient properties of these substances; they influence the diameter of the blood-vessels, the beating of the heart, and certain parts of the central nervous system, for example, the nuclei of the nerves of the heart [20].

It is absolutely proved that, of our chief nutrients, only the carbohydrates, and these substances positively, not only nourish, but produce as undecomposed carbohydrates a specific influence upon the bodily organs exactly as alcohol does. It is true that the experiments with carbohydrates have not been comprehensive enough for us to give more de-

tails. The specific influence of alcohol on the organs is much stronger than that of the carbohydrates. There are also many divergent opinions as to what organs are affected, as to the nature of the effect, etc.

This shows that alcohol is not the only substance which is both a nutrient and a luxury. In this again it shows a great similarity to the carbohydrates.

We have discussed the matter of how it can happen that alcohol acts as a nutrient and as a specific and how this is the case with other good, indispensable nutrients. The action of alcohol is therefore no exception, nothing abnormal, suspicious, or detrimental. We shall see that it is the same with the specific influence of alcohol.

I wish to state here that alcohol as a specific substance influences more or less the nervous system only; it acts upon different parts of the central nervous system or the peripherical end organs of the nerves or the glandular nerves, etc. The influence of alcohol upon the organs of digestion, the blood-vessels, and the glands is really only an influence upon the nerves of these organs.

Alcohol is therefore a nutrient and a nerv-

ous sustainer so long as it is taken sensibly. Science rightly treats only of the judicious use of alcohol, and hardly investigates the drunkard. I say rightly, because incessant overindulgence in any substance introduced into the body is injurious, no matter if the substance is a nutrient or not. For this we do not need scientific experiments and investigations.

What we are going to say in the following concerning the specific influence of alcohol upon the organs of circulation, the blood-vessels, and the heart will not change our opinion of the nature of alcohol.

Very little is known of the influence of the judicious use of alcohol upon the blood-vessels themselves through which the alcohol, absorbed by the juices, circulates with the blood. All the descriptions refer only to the confirmed drunkard or to the nerves of the blood-vessels. About the heart, opinions differ entirely at present. Only this fact is certain, that so far as direct experiments go, an injury to the heart muscle from the use of alcohol cannot be proved. Where such an injury seems to come from the use of alcoholic beverages, it is not the result of the alcohol, but of other ingredients or other circumstances.

We know exactly how much alcohol circulates in the blood through the heart even in deep inebriety, we know by experiments how much alcohol must be added to the blood passing through the heart before the heart muscle begins to work more feebly [21]. Comparison shows that even in the condition of deep intoxication the amount of alcohol passing through the heart is hardly much larger than the amount necessary to have an enfeebling influence upon the heart muscle, also that the amount, even in the deepest intoxication, does not come near the quantity of alcohol which would cause the cessation of the heart's beat. Men must become very drunk if the heart is to work more feebly. We have therefore the right to exclude such an influence from the life of a sensible person.

Another question is: If alcohol taken in moderation is not detrimental to the heart, can it act favourably upon the heart muscle? Opinions differ here. Practising physicians of great experience and skeptics among the representatives of clinical medicine mostly answer: "Yes." Anybody who has treated sick persons knows that strong beverages containing alcohol (strong wine, brandy, etc.) always

prove to be reliable when it becomes necessary to stimulate the flagging power of the heart.

Others have experimented directly with the hearts of animals, and state that they have not been able to detect a direct exciting influence of alcohol upon the heart. These experiments are of the greatest importance for sick persons [22]. The experimenters think that the favourable observations of the clinicians, which we cannot deny, are not to be interpreted as indicating a direct, but an indirect influence of alcohol, *i.e.*, the alcohol influences certain organs, the nerves of the heart, etc., and the improvement of the heart's action must be a sort of echo of this influence.

These experiments are of no great importance, as their number is very small and they have been made only on healthy animal hearts. The heart cannot beat more vigorously than it normally does, so that, if anything is to be proved, these experiments should be conducted on a weak heart. It is probable, according to the present state of science, that the clinicians are right who attribute to alcohol a stimulating effect upon the heart muscle itself, because, as we have seen, alcohol is a source of strength for the muscles. It would

therefore be peculiar if the heart muscle alone, of all other muscles, did not react to alcohol.

The inference would therefore be, as concerns the heart and the judicious use of alcohol, that practically there can be no detriment from the alcohol of alcoholic beverages, and furthermore that the question has not been definitively decided as to whether the proved stimulation of the heart's action in man is a direct or an indirect one. The other physiological facts favour a direct influence of the alcohol in stimulation of the heart muscle. It is probable that the heart muscle also uses alcohol as a nutrient, like the other organs of motion, from the skeletal muscles to the ciliated cells.

Our reader has now received a scientific explanation of the statement that we made in the medical part about the relation of alcohol to diseased conditions of the heart. As I have there been quite critical, a very necessary proceeding in this question, I refer to this chapter.[1]

[1] Note added during the printing of the book: In the meantime O. Loeb, of the Pharmacological Institute of Heidelberg, has proved, for the first time, by direct experiments the stimulation, though small, of the heart by the agency of alcohol. Loeb's experiments show, furthermore, that there is absolutely no weakening or enlargement of the heart from a sensible use of alcohol. (Compare *Zentralblatt für Physiologie*, September 23, 1905.)

We can here bring to an end the question referring to the influence of alcohol outside the nervous system. Everything else belongs to the following chapter, which treats of the influence of alcohol upon the nervous system. This chapter will be the most important one of the whole book. I shall therefore extend it to a length which will correspond to its importance.

V

THE INFLUENCE OF ALCOHOL UPON THE NERVOUS SYSTEM

ALTHOUGH one's knowledge of the nervous system may be large or small, everybody has the perception that it comprises excitable organs which are always more or less excited.

Two questions are always prominent in determining how a substance, for example alcohol, influences the nervous system: 1. Does the substance excite the nervous system or not? 2. Does the substance, regardless of whether it excites or not, influence the excitability of the nervous system, and if so, in which sense, increasing or diminishing it? These are the leading motives which we shall observe almost entirely in the following.

The nervous system is not a simple, but a very complicated organism. It comprises a central nervous system, with the brain and spinal cord as the principal representatives,

nerves which lead from these to the organs of motion and to the glands, and others which lead to them from the organs of the senses. To be added to these are the nervous end apparatuses in the muscles and glands and the organs of sense. Finally, the so-called sympathetic nervous system, which may be called a special network of nerve fibres with station-like nerve cells or ganglia in smaller or larger masses. This last-named network is connected with the nerves of the brain and spinal cord, and sends fibres to the intestinal organs, blood-vessels, and glands.

All this should be taken into consideration in a discussion of the influence of alcohol upon the nervous system. But we can speak only about matters known to us, and this fact confines the discussion.

We therefore can treat only of the terminal nervous apparatuses in the organs of the body, the nerve trunks, and the central nervous system, to the latter of which belong the brain, the spinal cord, and the sympathetic nervous system.[1]

[1] For specialists I wish to state that I naturally can specify no origin for the hypothesis of trophic nerves. What was formerly meant by these were nerves of the blood-vessels or glands, and sometimes the phenomena observed had nothing to do with nerves.

We begin with the end apparatuses of the nerves in the organs of the body. They may be divided into two chief series. The first of these, associated with the nerves of motion or secretion, perform the function of transferring the excitation of these nerves to the organs, to the muscle fibres (skeletal muscles, heart muscle, muscles of the blood-vessels, the intestines, the stomach, the bladder, etc.), or to the glands (salivary glands, stomach glands, etc.). If these motor (referring to the muscle fibres) or secreting (referring to glands) nervous end apparatuses are excited, a contraction of the muscle fibres takes place (effect, motion), or a contraction of the cells of the glands (effect, discharge of the cell contents, secretion).

The second chief series of the nervous end apparatuses is connected with the sensory nerves leading from the organs to the central nervous system. We call these sensory end organs, and divide them into two classes. The one has to perform the duty of transferring external irritation to the sensory nerves. This class is equivalent to the organs of sense from which lead the nerves of sense: the end organs of sensibility of the skin (effect of ex-

citation, sense of touch, the sense of cold or heat, etc.); furthermore, in the retina of the eye (effect of excitation, perception of light); in the inner ear (effect of excitation, perception of sound); in the mouth and nares (effect of excitation, sensation of taste, smell, etc.). The other class informs us of the condition of the internal organs. Here belong the nerves and organs of sensibility of the abdomen, which when excited give us the sense of abdominal pain. Here belong the sensory end organs in the tendons of the muscles, which inform our central nervous system of the condition of the muscles. Through these we not only receive the sensation of muscular pain or fatigue, but can also regulate through the muscular sensibility the duration and strength of motor impulses sent from the central nervous system to the muscles. These sensory nerve end apparatuses send their excitation through special nerves of sensibility to the central nervous system.

All these are sensory end organs which are capable of excitation and possess a certain excitability similar to that of the motor and secretory end organs.

We can now ask: Does alcohol influence the

excitability of the sensory end organs? So far as this question is concerned, we know nothing about the effects of diluted alcohol used judiciously.

Does alcohol possess the power to excite sensory nerve end organs? Yes, indeed, because alcohol has a specific smell and taste. It does therefore positively excite in a specific manner the taste apparatus in the mouth and the smell apparatus in the nose, like all matter possessing smell or taste. I and my associates perceive a positive sweet taste, without burning, if we use a one to ten per cent. solution of alcohol in water. The sense of smell is very agreeable, a perfume-like aroma, if the inhaled alcohol vapours are not too strong.

Alcohol in this solution, which corresponds about to the wines, affects other nerve end organs, for example, those of the mucous membrane of the stomach. But these have been insufficiently studied.

So much about diluted alcohol. Concentrated alcohol also excites the sensory nerve end apparatus. There is no doubt about it. But the influence is rather an irritant one in the sense of common usage. The excitation

is not only stronger but of a different kind, it is deeper, and suggestive of a chemical influence. It is noticeable by the sense of burning, and a certain diminution of the excitability of these organs, of longer or shorter duration, follows the strong stimulation.

The difference shown here between diluted and concentrated alcohol can be observed in the sense of taste of the wine drinker and the whiskey drinker. The first retains a very fine taste for all dishes all his life, without exception, while the taste of the other becomes obtunded. The amount of fusel oil in the whiskey is greatly responsible for the degree of obtundity. We must not forget that a good liqueur after dinner and a good brandy at bedtime have never produced such an obtundity of taste.

We will now speak of the motor and secretory nerve end apparatuses. Nothing is known about a direct influence of alcohol upon the motor apparatus in the muscles in the case of a judicious user of alcohol. Neither does the confirmed drunkard furnish us with data. It is possible that his nervous end apparatuses also become diseased, as so many of his organs become affected. But all this is

uncertain, as such investigations in the drunkard are seldom possible.

It is quite different with the glands. It has been absolutely shown that alcohol, even in small quantities, excites the secretion of the glands. From this we can conclude that the alcohol excites the nerves, as all cells of the glands are provided with a small end branch of the secretory nerve. We also know that alcohol can influence the secretory nerves by reflex action.

As soon as alcohol comes in connection with the mucous membrane of the stomach, a more abundant secretion of gastric juice takes place [23]. But we do not know whether the ends of the secretory nerves are directly influenced or whether the small amount of alcohol excites the sensory nerve ends in the mucous membrane of the stomach. From there the excitation would be carried by the sensory nerve fibres to the central nervous system, and would then be transferred in the central nervous system to the secretory nerve fibres leading to the stomach. The secretion of the glands can be performed in this roundabout way by reflex action via the nervous system. But enough! Alcohol produces excitement in either case.

It excites the secretory nerves of the salivary glands. But we know in this case that there exists no direct excitation of the ends of the secretory nerves of the glands, but an excitement by reflex action. The alcohol excites the end apparatus of the nerves of taste in the mouth easily, and they carry the excitation to the central nervous system, where it is transferred to the specific secretory nerves of the salivary glands. The effect is the secretion of normal saliva. Important is the transferring of the excitation of the nerves of taste (a minimal amount of alcohol placed upon the tongue still produces it) in the central nervous system, not only upon the secretory nerves of the salivary glands, but also upon those of the glands of the stomach. It is enough for the production of the secretion in the stomach merely to place the alcohol upon the tongue. This is an excitation of the secretory nerves from a second locality [23]. There is a third mode: A strong and long continued excitation of the nerves of secretion of the stomach takes place if alcohol is in some way added to the blood, but then an excitation of the salivary glands does not take place [24]. This isolated excitation of the nerves of the

stomach proves that the excitement is not a direct one, although the alcohol is carried with the blood to all the organs, among them the salivary glands, but takes place through the agency of an apparatus in the central nervous system. I think that these statements prove very well the old saying that a judicious use of alcohol is one of the best means of stimulating the gastric digestion.

Result.—In summarising our investigations of the end apparatuses of the nerves, we may say: Nothing is known of the influence of their excitability, if the confirmed whiskey drinker is not taken into consideration. We know positively that alcohol excites certain end apparatuses of the nerves of sense (nerves of taste and smell.) Alcohol also influences the end apparatus of the secretory nerves, surely by reflex action, somewhat perhaps directly by exciting certain nerve apparatuses which are connected with the secretory nerves of the central nervous system.

The end apparatuses of the nerves in the organs which have been discussed are connected with the central nervous system through the nerve trunks. These are either sensory or motor or secretory nerves. The

transferring of the excitation is their function; they are the telegraphic wires. They carry the excitement from the end organs of the sensitive peripheral nerves to the central nervous system, and from this system to the apparatus of motion and the glands.

We must now investigate the question of whether alcohol influences the conductivity of these nerve trunks. We do not know anything about this in reference to the judicious use of alcohol. A chronic inflammation of the nerve trunks is known in the chronic drinker, by which the power of conduction of the nerves is more or less influenced. But this happens only if a man drinks very hard for a number of years consecutively. This has nothing to do with the judicious man.

We have now reached the discussion of the central nervous system. This is the most important, but also the most difficult chapter. The following I wish to say as an introduction. I have come to the conclusion, by intimate study of this question, that it will be impossible to understand the influence of alcohol upon the central nervous system, which certainly exists, if one looks upon it with spectacles, the one glass being called

" alcohol brain poison " and the other " alcohol paralysis."

One will understand this question only if one discards the two expressions, brain poison and paralysis, and if one does not believe he is receiving a significant statement when he hears that a man lying in a drunken stupor " has a paralysis of several functions of the central nervous system on account of acute alcoholic intoxication." All these words do not mean anything. The scientific technical minuteness does not explain anything. The layman would understand it much better if the sentence was " The man is drunk." That would also be more correct, as we shall see later. If the layman understands what these words mean, and what men ever since creation intended they should mean, he will come to the same conclusion as if we used scientific terms.

The same is the case with chronic alcohol poisoning, or chronic alcohol intoxication, to use more scientific words. These high sounding words do not mean anything more than what men always intended when they said: A man who drank so much and for such a long time that he ruined himself. This is the first

point which ought to be understood; a second follows.

The conception of the word poisoning contained in these technical expressions does not imply anything new, exceptional, or even terrifying. What is meant by saying a substance is poisonous? It signifies that this substance produces in the otherwise healthy body disturbances of functions, not any kind of changes, but disturbances of a more or less severe nature, what we call in ordinary life disturbances.

An acute alcohol poisoning exists if we notice disturbances in the central nervous system produced by over-indulgence in alcohol happening but once.

I put the question to everybody: Did the layman ever understand anything else by this during the thousands of years in which there have been drunken men? I do not think so. The same is the case with chronic alcohol poisoning. This means disturbances produced by persistent over-indulgence in alcohol. If a layman says some one is a drunkard, he means the same.

It is a well-known fact, and it always has been known, that continued over-indulgence

in alcohol produces positive disturbances of the central nervous system. At present the fact only comes to us with the modern expression, " poisoning."

This is the second point which one ought to understand objectively, if he wishes to take part in the discussion. Through this point one also learns the real meaning of the word poisoning. I wish to make a restriction about the acute poisoning, *i.e.*, intoxication. This usually passes off without harm. It is a question whether we have a right to use the expression poisoning in this case. We shall see later that it has not been decided whether the so-called narcosis must be taken as a disturbance. It is probable that it does not belong to the disturbances, but to the normal conditions of the brain. But more about this later.

There are other usages of the word poisoning which in my opinion are without authority. The expression poisoning is used not only in describing positive disturbance of the functions of the central nervous system produced by the use of alcohol, but every change produced by the most judicious use of alcohol in the central nervous system, even if these changes have absolutely nothing to do with

disturbances. These changes are of greater importance and number in the practical life of man than the positive disturbances due to alcohol. All judicious drinkers are to be included in these cases.

If every influence of alcohol upon the central nervous system were to be classed as of a poisonous nature, we should maintain that almost every intellectually important man suffered from chronic alcohol poisoning. Cultivated human beings in general, men or women, have drunk alcohol in some form. All these must have suffered or still suffer from chronic alcohol poisoning of the brain, if every effect of alcohol is to be classed as poisonous.

Such sequences would necessarily be deducted if we did not carefully and exclusively limit ourselves in naming only positive disturbances poisonous. We have nothing to do with this. We demand that unquestionable, unchallengeable disturbances of health be demonstrated in each case where alcohol is said to act as a poison. That is the least we can ask, as alcohol is no poison *per se* to the organism, and so it is not a poison to the central nervous system. Alcohol may become poisonous under certain conditions, *i. e.*, under

the well known and well defined conditions of the absolutely intemperate use of alcohol.

Although this will be proved by a long chain of arguments, I shall here demonstrate it from a general point of view. First of all, there are no characteristic signs of poisoning in the sensible alcohol consumer. (*a*) There are no disturbances of the functions, not even of the central nervous system. This will be discussed very explicitly later on. (*b*) There will be no disturbances if the use of alcohol is suddenly stopped, even if one suddenly abstains from alcohol after a judicious and prolonged use of it for many years. I have made this experiment on myself.[1] (*c*) There will be no disturbances in the functions, including the nervous system, if a man uses alcohol judiciously, even regularly, all his life. Life teaches me this daily. Alcohol differs radically in these three points, *a*, *b*, and *c*, from the real poisons, morphine, cocaine,

[1] Provided of course one possesses strong nerves, or lives under conditions which do not ruin them. A man who lives in a great city and consumes much tea or coffee will become nervous more easily than an alcohol abstainer. The reason for this is that he avoids the only remedy (alcohol) with which before he has balanced the effects of living in a great city and the use of tea or coffee.

arsenic, etc. The points *a*, *b*, and *c* cannot refer to them.

Alcohol is therefore no poison. The fact that alcohol used in great quantities produces disturbances does not prove anything against this. What substance does not do the same? Albumin, carbohydrates, and fat have the same effect. We can daily meet enough examples of this fact in the streets. We must be moderate in everything. The measure for these substances is different; it is for albumin about a quarter or a fifth of the measure for carbohydrates. The measure for alcohol is still lower than for albumin, but much higher than for spices. We do not call these poison, to say nothing of caffeine.

Alcohol, used sensibly but regularly, is no poison. The fact that science nowadays calls it a brain poison does not prove anything against it. There is no substance which has a decided influence upon the brain that is not called a brain poison. This designation of substances which can be used in such doses as alcohol without danger does not mean anything to me or not more than a substance which influences the brain. If a substance possesses such a property, it is only natural

that a positive, more or less severe disturbance of the functions of the brain should be produced by the use of a great amount of it.

The majority of physiologists and pharmacologists are not prevented by the label "brain poison" from drinking a good alcoholic beverage. And still we physiologists and pharmacologists are reasoning men, are contented with our existence, and do not wish to commit suicide. Is there anybody who believes that we would drink wine, etc., even only moderately, if we understood by the name "brain poison" a real poison?

The public can rest quiet even if science calls alcohol a nerve poison. It does not follow that alcohol is by any means a poison in the usual sense of the word. It is the same with the expressions paralysis and paralysing effect. I shall explain this, why we meet with these words so often in everyday life. We call an effect paralysing, if it diminishes somewhere in the nervous system the excitability of the nervous organs. We do not care whether this excitability was before abnormally high or not, whether its lowering is beneficial or detrimental, and what circumstance produced this reduction of excitability. If I am nervous, and

my excitability is augmented from external influences, and I go into the garden and perform strong muscular work, my nervous excitability will disappear with surprising quickness. The muscular work has had a paralysing influence. I can attain the same end with alcohol. Muscular work and alcohol have a paralysing influence. When lightning strikes near a man, he is paralysed for a few moments, the strong excitation of his senses (which can also be an explosion) has made the central nervous system non-excitable by other events. A piece of bad news can make a man non-excitable by anything for a long time. If one concentrates his attention upon something, the excitability of the nervous system for other events will be diminished. If one part of the nervous system is stimulated to a more vigorous activity by an absorbed substance, the other parts will suffer a depression, a paralysing effect. What has the expression of science, "paralysing," to do with the layman's meaning of paralysing? I think very little.

All this seems to favour the omission of purely scientific labels, when one is speaking to the public. And the public will well under-

stand everything if it closely adheres to the meaning of the words it has always used.

Generally speaking, that substance alone is poisonous for man which in the general sense of the language produces signs of poisoning, positive disturbances of health, and a substance is then a poison only so long as it has such effects. Otherwise it is no poison. This agrees with experience, with logic, and finally with science.

Alcohol judiciously used is not a poison to the central nervous system. Nevertheless, alcohol used in this manner has an influence upon the central nervous system. We shall discuss this influence in the following.

VI

THE HABITUAL MODERATE USE OF ALCOHOL AND THE CENTRAL NERVOUS SYSTEM

Suppose, for example, one drinks daily three of four glasses of wine (the quantity can be double this amount according to circumstances); one will adapt one's self to the amount of alcohol contained in the wine in a shorter time than it will take to change the liking for rye bread to that for wheat bread. And if the influence of alcohol upon the central nervous system is taken into consideration, a certain depression of the excitability by external irritations and impressions and a certain exaltation of the inner psychic life will be observed.

That is the general impression which we receive. There is nothing to say of disturbances of the nervous life, but the lowering of the excitability by outside irritations and the excitability of the psychic life remain within

physiological confines. We are never equally excitable and never equally excited in our intimate psychic life. There is a certain space of action in which the influence of alcohol plays a leading part.

Our consciousness is entirely clear. The effect of alcohol has nothing to do with a narcosis. The characteristics of a narcosis are threefold: 1, Stupor, that is, an absolute dimness of consciousness, which can entirely obscure consciousness; 2, the necessity of increasing the doses of the same substance to produce the same narcosis (this increase varies with the different substances and is not even lacking for the sleep-producing substances); 3, the excitability of the reflex action is increased in the beginning. The reader will be instructed about the meaning of excitability of reflex action in the following.

The effect of alcohol does not show any of these characteristics of narcosis. 1. The excitability of the reflex action is decreased. 2. It is not necessary to increase the dose to have the same effect (the consumers of alcohol of whom we are speaking remain all their lives temperate). 3. Consciousness remains perfectly clear.

The alcoholic effect of which we speak has nothing to do with a stupor or narcosis. It is the effect in a man looking for stimulation, and differs widely from the effect in man looking for oblivion, which fact we shall treat of later in a special chapter. The latter ends in absolute drunkenness, while the other, of whom alone we are speaking at present, expects stimulation only from alcohol and remains always temperate. There are therefore two entirely different types which correspond to two different effects of the substance upon the central nervous system. The man who looks only for stimulation is right in maintaining that his case should not be confounded with that of the one who craves for oblivion. The mixing up of the two groups is furthermore unfounded, because it is not correct that every drunkard was once a temperate consumer of alcohol; the great majority of drunkards were even from the beginning never temperate, *i. e.*, they drank not to be become animated, but to become stupefied.

So much about this deviation. The reader will understand that the narcotic, stupefying factor is absolutely missing in the sensible, regular use of alcohol (please do not dissociate these four words).

We shall discuss: 1. "The diminution of the excitability for external irritation and impressions." 2. "Excitation in the sphere of psychic life."

We must explain first what is meant by excitability of the central nervous system for external irritation and impressions. We emphasise once more the fact that the question involves a certain diminution of this excitability, which happens otherwise, too, and under normal conditions, but not a suspension.

Which one of the excitabilities is meant? First we have the excitability which makes it possible that we are conscious of an irritation or impression such as hearing the report of a shot or observing an object in a room. This excitability can disappear, for example, while we sleep or are unconscious for some reason. It can be diminished to a certain degree (explanation later) when we are psychically preoccupied.

Is this excitability diminished under the judicious use of alcohol? Answer, "Yes" and "No," according to circumstances. First, "No," that is, the direct influence can be absolutely denied; otherwise the result would be that a man would be stupefied by the judicious

regular use of alcohol. And that is not at all so. There are many men who drink regularly a good amount of alcohol, and who possess a very acute sense of perception, such as hunters, seamen, etc. It is therefore not directly diminished by alcohol. But what does it mean that it is still diminished in a certain manner in the judicious user of alcohol?

We have stated that in a certain manner excitability of our central nervous system to external influences and irritations can be clearly diminished when our mind is much preoccupied, if a greater excitability exists of other parts of our mental apparatus. Our excitability for external irritations and influences is diminished if our mind or brain is preoccupied, if we are filled with a great joy, or if we have concentrated our faculties upon a certain theme.

The use of alcohol induces an excitation of our psychic life—we shall discuss this more explicitly later. It is therefore natural that a sensible consumer of alcohol, if he is anyhow easily excited in his psychic life, induces a certain reduction of his excitability by the use of alcohol, also indirectly a certain reduction of that excitability by which certain facts

of the outer world are perceived. A poet who walks in the meadows while inspired perceives hardly anything of the outside world; it does not matter whether he is inspired by alcohol or by something else.

That the reader may still better comprehend the difference between reduction of excitability for the outside world on account of a clouded consciousness (this is not the case here) and the reduction of the same excitability on account of excitation in other parts of our psychic life (this is the case here), I mention the fact that we can observe this in everyday life. There is a great difference if this excitability is reduced when we are going to sleep or when we are psychically more or less preoccupied. When going to sleep we feel the stupor, but under strong psychic preoccupation we are so busy that we do not for the time being notice that we no longer have so clear a perception of the outside world as at other times.

The same is the case with alcohol. We feel that stupor is getting the better of us as soon as alcohol narcotises us. As long as alcohol, as in its judicious use, only excites us, we are inwardly preoccupied, and sometimes so much

so that we do not notice that our perception of the outside world is not so clear as at other times.

The reason for all these cases is that the paralysis of perception is general in going to sleep and in alcohol narcosis (we have nothing to do with this condition). It is different with our psychic excitation (it does not matter whether on account of alcohol or anything else). There is no paralysis of the faculty of observation, not even a disappearance of all perceptions of the outer world. But our faculty of observation is so busy with one subject that it has no more space for other objects. If there is an excitation of the psychic life, this excitation imposes obstacles upon our faculty of perception—obstacles which do not belong either to the outer or to the inner world.

The poet inspired by wine walks through the country and does not notice the "Philistines," but he observes the fragrance of the flowers and the zephyrs of spring, and these two are the objects of his psychic excitability.

Here we shall pause for a moment. The chief point reached is the following: Alcohol, used sensibly and normally, does not of itself reduce the excitability by which we perceive

the happenings of the outside world; if such a reduction occurs, it is not due to the direct influence of alcohol, but to the reduction of the psychic excitation produced by it.

How shall we explain the other excitability of our central nervous system, by means of which we not only perceive, but convert our observations into sentiments, to speak physiologically: by which we obtain a tone of emotion, of the agreeable or disagreeable, of inclination or disinclination, joy or sadness, etc.? We can change the question and say: Does alcohol, used regularly and sensibly, make us more indifferent? Does it induce us to perceive a beautiful landscape as beautiful but with a reduced tone of emotion?

It is clear that this kind of excitability will not be reduced. Men have known this for a long time. They call a person who is not under the influence of alcohol by the same expression as a person whose perception of the outer world does not produce stronger sentiments. Both are called "sober."

Again, we must not forget that it is only when we accompany the perception of an action of the outer world with a tone of emotion, that we realise it. What we do not perceive

cannot excite an emotion. " I do not care for what I do not know." We have seen that the psychically excited man does not perceive many facts because his faculty of perception is preoccupied with other objects. It is therefore natural that all these tones of emotion should drop which would otherwise have come to the front if they had been accompanied by perceptions which are not now in the proper range. It is therefore of no import if we are psychically excited by the use of alcohol or by something else.

If the inspired poet—to again use our example—walks through the meadows and does not notice the beggar who sits by the wayside, lifting up his hand for alms, he does not have the emotion of sympathy which the beggar, had he been observed, would have excited. That is self-evident. Notwithstanding this, the poet's faculty for emotion is not paralysed, neither is his faculty of perception. On the contrary, he is filled with the strongest emotions. But his emotions and his perception of the outside world at that moment refer only to objects which are connected with his psychic excitation, which interest his excited ego. These he feels stronger than the " Philistines "

or the beggar, and these produce severer emotion in the poet than in the ordinary man. His emotions are directed to the fragrance of the flowers, the blueness of the sky, and the zephyrs of spring. To make room for them, the whole world with its emotions disappears, and with it the beggar and sympathy. I hope the reader will follow me.

With the regular judicious use of alcohol, a diminution of our excitability for exterior irritations and impressions, so far as we perceive them, and in consequence of that, of our emotions through them, go hand in hand. But the action is not a paralysis of our faculty for perception or emotion by reason of alcohol, but an effect of the psychic excitation resulting from the use of alcohol. As the excitation usually places in the centre of observation actions which appear or play in our soul, so does it retard the perception of actions of the outer world. These do not all disappear, but our psychic excitation selects some which appeal to the individual ego. Many must step to the background so that the ones that interest our ego may be better seen. If a psychic excitation takes place, it does not matter whether from the use of wine or from other causes, the

disappearing things of the outer world are different in the painter, in the poet, in the scholar, in the musician, in the contractor, and in the manufacturer. The depression of the excitability for external influences and irritation resulting from the alcoholic excitation in the soul is a different one in each individual. The degree is different in the individual, as it corresponds to the strength of the psychic excitability of the person in question.

We now come to a second section. I wish to call the reader's attention to a practical point. It goes without saying that there are many situations in life which will make the psychic excitation produced by alcohol valuable because they make us insensible to happenings of the outer world which do not fit into our inner life. Artists know the value of this. What is of greater value to the painter than to possess in alcohol a means which will, on account of the excitation of his artistic soul, exclude every action of the outer world which is not picturesque?

On the other hand, there will be situations in life when we wish to avoid the psychic excitation of alcohol, because it makes us less sen-

sitive to those actions of the outer world which really do not interest us. Unfortunately life forces us very often to pay attention to all kinds of incidents by overlooking which we should suffer. Under certain conditions it would therefore be better not to use alcohol.

If, for example, the painter rides down an incline upon his bicycle, he does not wish to have his artistic soul excited by wine, as he has to forget the picturesque view of the outer world and pay attention to other things.

There is certainly no reproach against alcohol in this twofold action. It is of value to excite my soul, but I must know when that should occur.

The number of our excitabilities for the outer world has not been exhausted, although we have discussed the excitability of our central nervous system for external irritations and influences. There is one of a special kind which is very important for us in our practical life, and which we must therefore discuss somewhat lengthily, especially as it will be strongly influenced by the sensible and regular use of alcohol. This, again, is not a direct influence, as we shall see, but it is a psychic excitation which will be produced by alcohol in a round-

about way. This excitability is the reflex excitability.

A few examples will explain the meaning: Suppose there are three persons seated at a table, all reading. The first has a so-called clear reflex excitability, the second a diminished one, and the third an increased one. Suddenly I strike the table with my fist, without the three having an idea of my intention. Result: Number one, with normal reflex excitation, is somewhat startled; number two, with diminished reflex excitation, only lifts up his head; while number three, with the increased excitation, receives an electric shock, and an involuntary exclamation escapes him.

In such a manner the three different persons react in entirely different ways to the external irritation (stroke upon the table) with involuntary motions of the muscles, corresponding to the degree of reflex excitation of the central nervous system, although all three hear equally well.

Another example: I steal upon a sleeper and tickle his cheek very lightly with a feather. Result: He turns his head and lifts his hand, resting upon the bed-cover, as if he would like to touch his cheek. He does all this without

waking up, without being conscious of my tickling or of his muscular motions.

The sensory irritation (tickling of the cheek), its conduction to the central nervous system in the form of an excitation of the sensory nerves, the transfer of this irritation to the apparatus from which motor nerves lead to the muscles, the excitation of the motor nerves and their effect, a reasonable muscular motion—all this takes place without the intervention of the will or of the sensibility. All these actions form a reflex, in which therefore the central nervous system reacts as an anatomical and physiological automation, without the participation of the functions which we should call the functions of the soul, psychic functions, as if these functions did not exist, the object being asleep. The central nervous system can therefore react to external irritation with appropriate muscular motion without the intervention of the psychic functions.

" To reflect " means " to radiate backward." The central nervous system as an anatomical and physiological machine throws back to the exterior the excitation of the sensory nerves, which reaches it as a sense irritation, in the form of motor impulses which are sent to the

muscles by the motor nerves. The effect of this backward radiation is reflex action.

There will also be a psychic action if we are conscious. But it can also happen if we are unconscious.

On touching with the finger the cornea of the eye (or if a foreign body, such as a small stone, flies against it) we involuntarily close the lid of the eye. The total phenomenon is called reflex action of the cornea. If we are conscious we feel the fact, besides having the sensation of something disagreeable; we feel the closure of the lid, we animadvert upon the causes, and the consequence of the touch, in short a great amount of psychic action may become involved. But all this is a secondary matter for the cornea reflex. This will take place in the same way if we are in deep chloroform narcosis, if every vestige of consciousness has disappeared. If the cornea of the person under chloroform is touched, the eyelid will close; psychic life is extinguished, but the automaton still performs its functions.[1]

It is this reflex excitability which plays an enormous rôle in life. It includes finally all

[1] No movement takes place if the anæsthesia is sufficiently profound to be called "surgical."—TRANSLATOR.

the reflex reactions of the central nervous system to external irritations in which it is not necessary that consciousness should take part also; perhaps our soul, our conscious life, is " somewhere else," as we say.

Furthermore, we know that the excitability is bound to certain numerous, central nervous apparatuses, the location of which we well know. The spinal cord, from its lowest end to its junction with the brain, is, for example, partly a real column of such reflex apparatuses.

The reflex emotion is more or less the excitability of the central reflex apparatuses, and is as such not suspended by the sensible use of alcohol, but plainly somewhat depressed.

This is shown by the fact that we do not twitch so strongly or with so many muscles of the body when we hear sudden sharp noises, that when tickled we do not make such vehement motions, that when some one touches our cornea with his finger we close our eye less spasmodically and with less participation of the other muscles of the face, that is, with less distortion of the face, etc. There is such a diminution of the reflex excitability as the result of even a small amount of alcohol if it

is regularly used. The author of this book notices it when he drinks half a pint of light wine a day. Therefore it exists, but the question is whether it is a direct one. According to the material before me, I can only say that it is not a direct, but an indirect one.

Psychic emotion alone (each occurrence of which diminishes the reflex excitation, so long as it has not been increased too much pathologically) does not explain this effect of alcohol; there is a fact which is not reconcilable with the opinion that alcohol sensibly used directly diminishes this excitability. The fact is this: In the regular but injudicious use of alcohol, by the confirmed drunkard, there will often come times when this same reflex excitability is greatly augmented. Those are the days of delirium tremens [25].

If we now place next to this statement the other, that the same reflex excitability is diminished by the regular and moderate use of alcohol, we shall, if the diminution is due to a paralysing influence of alcohol upon the nervous reflex apparatus come to the peculiar conclusion that alcohol in small doses paralyses, and in large doses excites the same apparatus. But such a thing never hap-

pens either in physiology or in pharmacology. It happens indeed that a substance taken in increasing quantities first excites and then paralyses the nervous elements, but such a fact as that a substance in small doses paralyses nervous elements, and in large ones excites, simply does not exist. A direct paralysing influence of alcohol upon the central reflex apparatus is therefore to be excluded as attributable to the moderate and regular use of alcohol, so far as our knowledge goes. Nothing remains but the fact that the existing diminution of the reflex excitability must be produced indirectly. That not only may be the case, but it must be.

The use of alcohol produces a psychic stimulation which in turn will decrease the reflex excitability. This it always does in the normal nervous system; it is so infallible that —and this is an elementary principle of physiology—we can never study the excitability of the reflex transporting central apparatus in its absolute purity so long as the psychic, the brain functions are in some way excited.

This statement is not new to the layman. We touch our forehead if an insect alights upon it and produces an itching sensation in

the skin. That is a reflex motion which we also perform unconsciously in our sleep. We know that we can stop this reaction when we are absolutely resolved to do it. If the itching increases, we perceive the conflict which takes place between our will and the sensation that rouses the excitability of the reflex transporting central apparatus, which sensation is produced by the itching. Even more than this. We feel the will contending against the sensory impulse with the same central apparatus, the tendency of which is to provoke the sensory excitation to the point of grasping. It impels this central apparatus to perform other motions, as we know that we must strain all our muscles to pervent them from "grasping."

Every man can convince himself by self-observation that excitation of the brain may retard the reflex excitability. The example which we cited just now shows how a conception of the will, the object of which is the same itching, may retard the reflex motion. We, therefore, feel directly how the brain excitement battles with the excitement of the sensibility of the skin for the supremacy in the central nervous system, from which the motor

nerves of the body receive their impulses.

The matter is not always so plain. But we can perceive the same retardation in many cases of our friends, even if they are not conscious of it. Every one must certainly have seen a friend so excited, perhaps in his psychic life, perhaps by strict attention to a certain object, that he did not perceive the fly creeping over his forehead.

It is not astonishing that psychic emotions generally very much and very frequently retard the automatic reaction of our central nervous system towards external influences and irritations for the principle of this is partly explained by the anatomical relation of all single parts of the central nervous system concerned in the matter. Otherwise, without this retarding principle in us, we should, on account of reflex motions, seldom perform an action in such a manner as we should wish according to our psychic personality. It is therefore self-evident that my reflex excitability will be diminished on account of my psychic excitation by alcohol.

Result.—We have seen, not only that we must renounce the idea of a paralysing in-

fluence upon certain central nervous apparatuses when we wish to explain the diminution of the effects of external influences and irritations by the judicious use of alcohol, but that there are facts which are incompatible with this idea. We therefore have to look for other causes, and in doing so we meet with no difficulties, as the sensible and regular use of alcohol produces at the same time a psychic excitation. And this naturally produces a certain diminution of the reflex excitability and also of the psychic excitability for external impressions according to its strength and the psychic capability of the person.

The result leads us to the conclusion to examine very closely the psychic excitation produced by alcohol, an excitation which we are forced to take into consideration as a whole because such a phenomenon as is presented by the influence of alcohol may be divided only artificially. In reality it is indivisible. We cannot discuss one side of the question without referring to the other.

We begin our second part with the question: In what does the pyschic excitation produced by the sensible and regular use of alcohol consist? We usually confine ourselves to saying

that the sense of power is augmented and that the perceptions of will can be more easily changed into acts of will, performances of will. Familiarly, one says: "The alcohol stirs me up."

Indeed, the expression "stirring up" answers very well in all its brevity. Alcohol stirs one up. That means that it does not produce entirely new psychic properties. We can stir up only matter which already exists. Alcohol stirs me up! That signifies that it puts my psychic ego into excitation.

When do we say: "I am in good humour to-day"? Hardly when we are disposed to memorise ciphers or to exercise some other mechanical function. On the contrary, we are generally (I have to speak here of a certain class of men, otherwise I should omit the word generally) not disposed to perform such duties on a day when we are in good humour, and on account of it we are not willing to do such things. If we are in good humour we want to do something better. The musician does not wish to practise exercises, but to compose or interpret; the painter, not to divide his canvas into squares, but to realise his inspiration in form and colour; the writer,

not to listen to essays critically, but to develop his ideas; the scientist, not to cut up a piece of liver into a thousand microscopic parts, but to follow up his ideas about an object very interesting to him, etc. In short, when we are in good humour we do not want to copy, to imitate, we want to create independently.

And alcohol produces such excitation. It is not that part of our psychic life which is merely imitative, receptive, or passive that will be especially excited, but the part which makes us creative, psychically active beings. Alcohol excites our creative faculty, of which our personal psychic ego really consists. We should emphasise: I am excited by alcohol. Therefore creative men, the discoverer, the artist, do not allow anything to be said against alcohol.

We must be careful to avoid two errors: We must not imagine that alcohol brings entirely new properties to the brain, to the soul. For example, a man not gifted with the talent for painting will not be able to create a masterpiece by the help of the best brandy. He who has not the natural gift of painting can do nothing. But if one is gifted, wine will not seldom assist the talent to show itself.

It has been said, for example, that nobody

becomes talented by means of alcohol [26]. That is right and it is wrong, according to circumstances. Certainly a man who is not endowed by nature with an ingenious brain, who is not capable of psychic excitation, will not become ingenious through the agency of alcohol. But the man who is ingenious by nature will indeed show his ingenuity best after the use of a glass of wine, and in that way will become ingenious by the instrumentality of alcohol. The faculty of the brain to be ingenious is not identical with actually being ingenious. Neither is a person gifted with the faculty to paint, a painter. There is a great difference! The gift is a valueless asset until, for example, there has been developed from the disposition to be a great painter, the state of actually "being a great painter." This development may be repressed, impeded, or accelerated. This last happens in many as the result of alcohol, which produces an exaltation of the endowed soul, the endowed brain. Then will the man paint according to his capability.

What has been said about the higher spiritual and psychic endowments may also be said about the other capabilities which belong to

the personal psychic ego of man. The same is true, for example, of the temperament. Alcohol is never the cause of a man's having a bilious or melancholic temperament, but by its exciting action it brings out the temperament. From this may be seen the different results of alcohol: one man will become jolly (sanguine), another pensive (melancholic), the third furious (bilious), and Olympic quietness overcomes the fourth (phlegmatic).

In short, the effect of alcohol is not that of creating gifts which the brain does not possess from nature, but it places the parts of the brain which possess such capabilities (to use this figure of speech) in higher excitation. Thanks to this action, the capabilities will often become actively operative.

Two things therefore are necessary for a personality—an organisation of the nervous system which comprises the capabilities of emotion and reason, and the circumstance that this nervous organism is really commensurately excited. If such an organisation of the nervous system is missing, no personality will be formed, notwithstanding the exaltation. A cretin always remains a cretin, and if he drinks the best wines, his cretinism will show

up all the more clearly. If the excitation is missing, there will be no personality formed. Certainly alcohol can produce only excitation, not organisation. Alcohol does not give a new character to a man, but it shows up the whole psychic man and his character. It will not be the fault of the alcohol, but of the person, if the character is not beautiful. Alcohol does not make a man unprincipled, but it shows the deficiency of his character. It was of importance to me that an alienist admitted in his modern text-book that many drunkards were in a high degree deficient in their character before they began to use alcohol (27). That endorses my explanation.

This is the first error which we shall have to avoid. The second, which we should no less avoid, is the fact that we are inclined to refer the psychic excitation to the sensory life, understanding by that that the intelligence is diminished. That is entirely wrong.

One will avoid this error if one always remembers that alcohol excites not only one part of our psychic personality, but the whole of it with all its qualities, and of what kind they may be makes no difference. If there is an excitation, the psychic ego will appear with all

its *annexa*, with its temperament, its emotions, endowments, and intellectual capabilities. The result will be different according to the share of the original brain that each of these qualities represents. That is not the fault of the alcohol, but the fault of fate, according to which these qualities of the ego excited by alcohol are mixed.

The result of the " ego excitation," as I shall now call it, will be (whether alcohol was the producer or not; it will often occur from other reasons), at one time an artist like Menzel (realistic, intellectual), or a Böcklin (no trace of intellectuality, but fantastic), or a mathematician, etc. It depends upon the original disposition whether the excited psychic personality will show itself more in the field of emotion or in that of intellectuality. The whole erroneous opinion that alcohol diminishes the intellectual faculties is arrived at from the misconception of certain of the simplest of the processes of thinking. These more or less simple, even most simple, processes which in our psychic life are not one's proper objects, but only means for certain purposes, indispensable assistants, but all the same only assistants, are taken for essential objects of our

psychic life. We imagine that they will fare worse if they are placed at the service of our excited, dictatorial ego, instead of serving external influences.[1]

The excitation produced by the sensible and regular use of alcohol does not in the least diminish our faculty of thinking—it is often even augmented—but it changes its direction. We do not think less assiduously, but only of something else, of that which fills our soul.

I know, for example, of a mathematician whose mathematical gift was clearly stimulated by the use of alcohol. Under its influence he was exalted and capable of solving mathematical problems, but incapable of keeping accounts while playing cards, or even of playing the game satisfactorily. He pondered on the higher mathematics and at the same time disturbed the whole game of cards.

Now, it requires more intelligence to study the higher mathematics than to play cards. One cannot maintain that the intelligence was diminished in this person by the use of alcohol. The chain of facts is the following: The

[1] One will understand that it looks as if more mechanical faculties of our intellect were often (not always) checked if a man is psychically excited from alcohol. This is an explanation of the result of certain psychological experiments.

person was without doubt endowed by nature with a mathematical faculty. He became active by the use of alcohol and was now pre-eminently a mathematician; the processes of thinking, acting as his assistants, attended to mathematics only, according to the orders received.

We see the same thing in everyday life. If in the evening, over his glass of wine, a merchant becomes a pleasant companion, *causeur,* or speaker, we cannot say that he thinks less than during the day. He only thinks of other matters. His operations of thinking are now more at the service of his psychic personality, which induces the thinking into its own sphere and directs it to other objects of the outer world. During the day his thinking did not serve his ego, but his business.

Later on we shall see that the power of judgment and self-criticism is rather increased than decreased by the sensible use of alcohol. If a reproach were to be made against alcohol, it could only be that it places the thinking powers at the service of the psychic ego, and that this is sometimes not opportune. Practical life very often does not allow us to be full human beings, but forces us to place our thinking

faculties at the service of strange ideas which come to us from the outer world. The merchant may say, " In my office I am a business man, not a human being."

This is, again, no reproach against alcohol, but against those who drink it at the wrong time. Furthermore, it is no reproach against alcohol if the excitability of a psychic personality does not produce anything beautiful, and if this personality places the thoughts at its service. That depends upon the qualities of the person. *Quod licet Jovi non licet bovi.* One must always remember that alcohol is the exciter, but cannot change the quality of that which it excites. What is excited is our own psychic personality, in short, our personal ego. Everybody will understand what is meant by the personal ego. Our entire ego is rendered active by the use of alcohol.

If the word " entire " is emphasised in the combination " entire ego," we shall avoid the erroneous opinion that alcohol excites only this or that emotion. No! It makes all the qualities which compose our personal ego active —temperament, sensation, endowments, and intellectual faculties. The result is a psychic comprehensive condition which will only be

non-harmonious if we have from nature a preponderance of one or more qualities. And that is the case, for example, with a man with a certain predominant gift.

On the whole, it can be said that temperament, sensibility, endowment, and intellect are combined in one form. Feeling and thinking are united—one is a complete human being.

Furthermore, we have to emphasise the word "activity." We know exactly what we want and we transform our will easily and with little resistance into action, only if our emotion and thoughts are united. Then we act with the feeling of greatest security and psychic satisfaction. And that is only natural. Our "action" is then only the reaction of the excitation of our psychic personality upon the muscles of the body. That also can be understood anatomically and physiologically. The central nervous parts the excitation of which refers to our psychic personality do not exist isolated in us, but are surely connected with a good many other, especially nervous apparatuses. And, since each excitation spreads with increasing strength in the nervous system, it can be understood that the ego excitation produced by alcohol reaches among

others also the transfer apparatuses, from which lead nerves of motion to the muscles of the body. We know that these transfer apparatuses are the same as those which, under reflex excitation, are affected by sensory excitations coming from without. It depends only upon which is the stronger (compare what has been said of reflex retardation). If the psychic excitations are stronger, they capture the transfer apparatuses and place the muscular system at their service. Under this condition we shall act principally according to our psychic excitation.

Finally, the general form of expression distinguishes the degree of will action which we perform according to the form and wishes of our personal ego from the low degree of our other will actions which we perform on account of " reasoning " or " with a certain point in view."

Alcohol excites what we call our personal ego, all the qualities which make up our psychic personality, that part of our psychic life which makes it possible for us to be beings of decisive psychic activity. Under this excitation ideas of the will are more easily transformed into action than at other times. It will

happen also if the will is influenced by stronger emotions.

We have shown analytically in our last paragraph of what the psychic excitation produced by the regular and sensible use of alcohol consists. Furthermore we stated in the paragraph before the last that this excitation would then in turn reduce the reflex excitability and the psychic excitability for external impressions and irritations. We now ask: How does this psychic excitation originate?

We know the sequelæ (and have spoken of them in our description of external influences and irritations). We wish now also to know the reasons. That is easily asked, but nearly impossible to answer on the basis of our present knowledge. We therefore have to be satisfied with the question: Does alcohol itself excite our psychic personality directly, or does it first produce paralyses in other parts of the brain, which in turn produce an excitation of our ego?

Some authorities explain the stimulation from the use of alcohol in this latter manner. But there are others who take it for a direct alcoholic effect. Besides the scientists, the

general public has become interested in the notion that the well-known stimulation of alcohol is the sequence of some paralysis. I must therefore treat this question very explicity. The idea that the reason for the stimulation is really a paralysis naturally and with good reason disquiets men who drink alcohol for its stimulating influence.

I shall not torment the reader unnecessarily. I cannot accept the theory of paralysis offhand, but I shall show that the stimulation arising from the regular and sensible use of alcohol is a psychical excitation produced directly by alcohol.

We can therefore submit to this useful and beneficial stimulation, and need not be afraid of becoming the victims of any manifest or disguised paralysis. We shall not express an opinion against which other opinions, also well founded, can be cited. There is a chain of facts which make it simply impossible for us to accept the theory of paralysis here. In the following we shall give the reasons for our decision.

1. It happens unquestionably that alcohol sometimes produces paralysis in the brain. That is an old experience and by no means a

discovery of science. It happens when men drink more than they can stand, when they become intoxicated. It is well known that under these conditions the power of judgment has been diminished, that a man says and does things which he would not have said or done if he had drunk only his usual measure. But then a man is at least more or less inebriated in the general sense of the word. As long as a man drinks alcohol regularly and judiciously his power of judgment, for example, will not be influenced.

If business men come together in the evening and drink their glasses of wine, they may express different opinions from those expressed when they are sitting at their desks during the day. But their judgment is neither more nor less clear. They now judge as human beings. Thanks to the alcoholic stimulation of their psychic personality, they now give quite frequently a more correct, more consistent, and better opinion. That does not occur because the business man in them is paralysed (on the contrary, business is often transacted over a glass of wine), but because their entire personality now speaks. Business transactions are then not judged accord-

ing to motives which influence the office hours, but these motives are criticised. The criticism given is from a much higher standpoint than during the day. Man himself is then in a condition of higher criticism. He may confide to his friend, "I should have acted differently, but what could I do? During the day I am only a business man." In short, the power of higher judgment and self-criticism is rather augmented by the judicious use of alcohol.

2. Psychic excitations will always be observed from the use of alcohol, and they are of such strength and of such elementary power, if large quantities of alcohol have been used, that it is not to be thought of that they could be induced only by the removal of influences that, but for alcoholic paralysis, would have checked them. If a man has once treated a delirium tremens case, and I have treated such cases, or has seen an attack of madness induced by carousing, he will, I think, be cured of the idea that such cases could be induced by the suspension of checking influences. No man rages on account of suspension of inhibitory influences, but because he is the prey of an only too plainly visible excitation.

But the opposite is, I suppose, quite right.

The exciting influence of alcohol upon the brain is so strong that the excitation often predominates in a few parts of the brain which are perhaps already paralysed (nobody denies that for the injudicious use of alcohol) in such a manner that the whole external behaviour of the person shows the signs of insane excitation. The use of alcohol in all its forms teaches that alcohol absolutely excites the central nervous organs connected with the inner soul life.

3. Finally, it is true that the same entire complex of fact which is shown by the brain excitation produced by the regular and judicious use of alcohol (with all its sequences, including the simultaneous diminution of the psychic and reflex excitability in reference to external influences and irritations) very often may occur without any use of alcohol, without the introduction of any artificial means. All this happens under conditions where certainly only a direct psychic excitation is in question.

Even the average man not infrequently has days when he feels as inspired as if he had taken wine, when he feels like a thorough man. These conditions of excitation of the personal ego are more pronounced in a specially gifted

and original personality, that is, in a genius. If the hour of inspiration has come, the same condition of brain and soul excitation can be observed with all its phenomena described by me as the results of the regular and sensible use of alcohol. The personal ego becomes active in all its attributes (sense, temperament, intellect, gifts), but the excitability for external influences, especially the reflex excitability, is diminished.

If such a person "composes," "paints," or "thinks of his mathematical problems," he does not see or hear anything but that to which the attention of his psychic personality is directed. It may well be said that "the psychically excited man looks at the world with entirely different eyes."

It can be seen that the psychic excitation produced by alcohol is nothing hereditary or specific; it is of a kind which also appears spontaneously with all its consequences. We produce it arbitrarily by means of alcohol when we should otherwise have to wait until nature and life were ready to produce it. Thanks to alcohol, we have a means by which we can produce it at any time when we wish it or when it pleases us.

This point is followed immediately by a second. It is clear that this psychic excitation is original where it appears spontaneously. This originality diminishes the excitability in other fields of the central nervous system, but it is never produced by the removal of opposing emotions in other fields of psychic life. The removal of inhibitory emotions plays an important rôle when we try to trace the origin of paralysis to the use of alcohol. It is therefore advisable to get at the kernel of these inhibitory emotions.

We do not take into consideration the fact that the influence of an artificially hindering remedy is of itself excluded where the psychic excitation appears spontaneously. If an emotion of our personal ego depended upon the removal of hindering sensations, it must usually occur when we were in situations where we did not have to worry or were not constrained. But that is absolutely not the case. The intelligent man often does not show any wit when he is not constrained. If we view a personality only from its temperament, we shall observe that the bilious, when he is not constrained, may be the most inter-

esting, the sanguine, the most tiresome. In studying the biographies of great creative personalities (Luther, Goethe, Beethoven, Schubert, Hebbel, Fichte, Schiller, Bach, Rodin, Cervantes, Shakespeare, Michael Angelo, Rembrandt in the second half of his life, etc.) we find: The excitation of the ego produced in inspiration (which creates, when the "inspired" is the man to do it, the greatest works) takes place— if it comes at all in contact with restraining sensations—under entirely different conditions than are presupposed in the idea which is expressed by the sentence "excitation originating from suspension of hindering actions." The life of spiritual heroes was usually constrained by conditions which would produce inhibitory sensations. But it is peculiar that the power of production was rather diminished when these sensations disappeared.

The idea that alcohol excites us because it paralyses opposing emotions in us seems to me psychologically impossible. I shall state these psychological reasons as briefly as possible.

a. There is no paralysis in the central nervous system during the condition of

interior "exaltation." This should be the case if the "exaltation" was the sequence of a "paralysis."

Everybody knows that he looks upon the world with entirely different eyes when he is inspired, that he is an entirely different man, that a change has taken place. These changes are changes of observation: one perceives things and sees things from a different point of view, things which were not observed before, while others, observed before, disappear. Furthermore, there are changes of sensation. One does not have sensations which before were clearly defined, but one has other sensations, partly very intense, which he thought himself incapable of. There is also a change of reasoning: one has ideas and idea associations which did not appear before, and, conversely, perceptions disappear which before were obtrusively noticeable.

Everything is change, but not omission, paralysis. Anyhow, what should be paralysed? The observation perhaps? But the inspired observes with full intensity, only differently from what is usual. The painter, no matter whether the excitation comes from wine or not, sees everything from the artistic side

only, but this in the most intense state. His observation perceives other objects and objects from other points of view when he is not excited.

Or should the sensation be paralysed? Well, when do we feel more energetically than when inspired? Or the reasoning and the criticising? Not at all. I have demonstrated before that we do not think or criticise less acutely when we are inspired, we only think and criticise from other standpoints. Which function of the brain is, therefore, paralysed when we are inspired? Answer: None.

In fact, the question from the psychological standpoint is not about the diminution of the excitability of any brain function, but about the fact that every brain function—and that includes the various central nervous apparatuses—is not any longer or not more strongly excitable for certain impressions because the apparatuses are too strongly occupied from the psychic personality (*i. e.*, the "inspiration") through the excitation.

It must be mentioned here that it is a principle of nervous physiology that every nervous apparatus strongly preoccupied from one side is correspondingly inaccessible to

occupation from another side. If, therefore, a painter like Rembrandt or Leibl is stimulated, the excited psychic personality, *i. e.*, the painter ego, rules in him observation, feeling, and thinking. It is obvious that these same functions in Leibl and Rembrandt cannot be usurped at the same time by the non-painter; they are not paralysed, but they are so much engaged otherwise that they are not responsive to other impressions. The supposition that the excitation produced by alcohol takes place in the brain in consequence of paralysis is untenable for the simple reason that nothing is paralysed.

b. Furthermore, the removal of checking sensations does not produce inspiration, because such checking sensations appear only when we are inspired, be it by alcohol or by anything else. It depends entirely upon the strength of the inspiration and upon external circumstances whether alcohol will, by its direct production of inspiration, awaken or remove in us checking sensations.

One can see that in himself quite often. When do we have pronounced checking sensations? Answer: When we, following the inspiration of our personal ego, wish to act

upon certain lines while, following external circumstances, we should act entirely differently. Besides, it depends entirely upon the situation, upon the personal ego, upon the conception, upon the feeling of not being free from external circumstances which would prevent one from following the internal desires, or upon the feeling of uneasiness from one's own inspiration which would make it difficult for one to follow external circumstances or conventionally prescribed principles.

However that may be, the principal condition for the originating of checking emotions is that one himself is or is to be inspired to a certain degree. If my ego is not inspired, if my inner original personality is not at least active, I shall not be placed in a position to prefer to do such and such a thing. I shall then feel checking sensations very seldom.

We go to business hundreds of times, not so very contented, but still relatively satisfied and not at all in a disagreeable mood. We cannot be said to have pronounced checking sensations. Suddenly, early on a spring morning, we feel ourselves inspired, and if we are then not thorough business men, if we do not possess an absolute business ego, we shall

on that day suddenly have checking sensations. We then feel it burdensome to have to attend to business every day, and think if we only could do as we wished we should not go to business. And why all of a sudden these checking sensations? Answer: Because we are inspired. We only then become aware of the contradiction between the personal psychic ego and its wishes and the rest of the world.[1]

A concert attended in the forenoon by a musical man can produce checking sensations in the afternoon when external circumstances force him to work in his office.

If one is not a born chemist, a delightful luncheon with a few glasses of wine will produce checking sensations in one in the afternoon at the laboratory. Then one feels that it is a shame that one has to work in a room full of chemical vapours and smells. The wine has inspired us and we realise that perhaps we are not made for a chemist.

There is hardly any surer means of pro-

[1] If we possess a business go, if we are thorough business men, we shall have checking sensations only on that day of inspiration, when we cannot attend to business. The change of having checking sensations and "not having" takes place very quickly sometimes, from one day to another, from forenoon to afternoon.

ducing checking sensations than a few glasses of wine at a time at which it would not be permissible for us to respond to the inner inclination originated by the wine. That may be the reason why so many representatives of a vocation prefer to drink their wine in the evening only. They are then free to excite their inner personality, because they are relatively independent of external affairs. The inspiriting effect of the wine will have disappeared in the morning, when the ego has again become quiet.

Men are well aware of the whole business through their experience. They well know that it is not always pleasant in practical life to be psychically excited by alcohol. If we cannot follow our inclinations under such conditions, we are a prey to disagreeable checking sensations, an unpleasant condition in which man becomes peevish and discontented.

Our first conclusion, therefore, is that alcohol (through the psychic excitation produced by it) causes restraining sensations only when the external situation does not harmonise with the stimulated ego. Then only many observations, ideas, etc., produce such sensations.

These inhibitory sensations will naturally

not be produced if we can obey the inspiration. That is also shown only too often in practical life. Stimulated at noon by wine, we shall have checking sensations in the afternoon if we are forced by external circumstances to attend to a vocation to which we are not inclined body and soul. But these will not appear if it is a Sunday, when we are at liberty in the afternoon.

The conditions as to the checking sensations are rather complicated, especially as the following is to be added: Usually one does not feel any checking influences if the inner personality is not excited, or if the whole situation permits one to follow the excitation of the inner personality. But there is a third condition when no checking sensations appear, and that is if the psychic personality is so highly excitable and so extremely excited that one remains indifferent to everything else.

This third condition does not occur often in the average man, but it is not infrequent in people who possess a very pronounced and very excitable personal ego; it is the normal condition of the genial man. Though I can only mention this matter, so very important a theme for the understanding of human

actions, I wish to say: This third condition proves the fact that the excitation of our inner personality, which in a lower degree, as we have seen, first creates checking sensation in us, prevents them after a certain point.

I shall explain what I have said by an example: Suppose an old man clad in rags, with a beautiful head, acts as model for a genial painter. If this painter is excited to the highest degree, the excitation in his painter ego rules without any remnant of his observation, feeling, and thinking. He is only a painter. In this condition it does not matter to him whether the old man trembles, hungers, or feels cold; the old man is only his model. This case shows us a deficiency of checking sensations from too strong an excitation of the ego. If the old man fainted, the genius would paint him as a "collapsed old man" instead of a "standing old man." (It is stated that Menzel said to a young man who ministered to a fainting model, instead of painting him in the fainting spell, "You have not a drop of artist's blood in your veins!")

Second case: The painter is not stimulated to the highest pitch, or he is no genius, not capable of such a painter ego excitation. He

still observes the socially affecting exterior of the old man only from the artistic point of view. If the old man should tremble violently, perhaps collapse, the painter would be interrupted. "I had a fine inspiration, but the old man collapsed. I then thought that perhaps he had had nothing to eat or that he felt cold, and if I notice that in my model it embarrasses me in painting." We have here checking emotions through a medium or weak ego excitation to which the other external conditions do not correspond. Böcklin would have said to the painter: "Take a brandy."

Third case: The painter is not inspired at all, and does not feel like painting when the model appears. He does not paint him, he does not care to. But he notices the poor condition of the old man. All of a sudden he becomes interested in the human being in his model; he gives him a piece of money and goes away with exalted emotions. Here it is the lack of checking influences from want of excitation of the inner personal ego.

The same we see, for example, in officials or business men who really are capable writers. They attend to their business if they are not inspired and have no checking sensations. If

they are somewhat inspired and must go to business, they have some checking sensations; if they are excitable and excited to the highest degree, then they " do not give a continental about the whole thing." The idea that they should go to business does not enter their head. The excitation of their inner personality to the highest degree is that of a " really gifted writer " and it does not permit of the rising of checking sensations.

It is clear that checking emotions will arise only if the inner personality is somewhat excited, but it is also clear that they cannot arise if the inner personality is too strongly excited. If we comprehend this fact, we shall also understand the action of a genius, incomprehensible to the average man, who gives up a good position (like an old coat) in following his excited ego. Furthermore, we shall understand why prisons and penitentiaries are always crowded in spite of much struggling against temptation. That which is strength in a happily endowed man is debility in the unhappily endowed man.

Only those who think of this will understand that the inspiring alcohol can produce checking sensations, and, again, can remove them,

all according to the conditions and the excitability and originality of the ego. Such are the relations between the checking sensations and inspiration including alcoholic inspiration. They are diametrically opposed to the hypothesis that exaltation produces paralysis of checking emotions.

What, now, does the judicious and regular use of alcohol produce? Answer: A certain psychic excitation, the excitation of our personal ego. The result depends entirely upon the quality of the excited ego. The strength of the excitation depends partly upon the excitability of the ego in question and partly upon the quantity of alcohol regularly used. The necessary physiological sequence of this excitation is a certain diminution of the reflex excitability and of the psychic excitability for external influences and for certain aspects of the outer world, *i. e.*, only for certain external influences depending upon the degree of the excitation and the quality of the ego. The reason for this diminution of the excitability is not to be found in a kind of paralysis, but in the fact that the central nervous apparatuses concerned must work in a certain sense on account of the ego excitation, and are there-

fore not accessible to other demands. There is an absolutely clear consciousness and no narcosis.

Several practical facts correspond to this result. It has been observed for centuries that alcohol augments the self-consciousness, the sense of power, and the courage. And that is absolutely true. Nothing can stimulate these fine faculties so well as the excitation of our inner personality, its becoming active. This must increase the self-consciousness; it is in great part identical with it, and the higher my self-consciousness is the greater naturally is my courage. The saying about "getting courage by drinking wine" is no illusion, but corresponds to well founded real conditions.

We have also known for a long time that the results are various when men drink alcohol. This is natural, as alcohol excites only the existing psychic personality, which is different in different people.

If it is said to be peculiar that alcohol has always been used by civilised man, although different results appear in different people, we can answer that that is entirely natural. The kind of excitation produced in men is the same in all although the external effect in the

individual differs widely. Everybody feels inspired, and that not only makes him feel well, but it is sometimes also absolutely necessary for the health of the nervous system.

He who leads the life of a shepherd in Arcadia may indeed be satisfied with goats' milk. And still the shepherds drank wine. But what about him who does not live in Arcadia? What about him who has to comply with the daily increasing demands of practical life? What would become of his psychic personality if he did not possess alcohol? What would become of the psychic personality of all the many men who during the daytime cannot act as they would wish and must according to their ego? They would often pine away without alcohol. No function of our organism can be neglected or suppressed without detriment. Our so-called psychic personality comprises a complex of principal functions of our organism. The depression and repression of our personal ego will be avenged in time, and in this may be a cause of neurasthenia, or of ordinary nervousness. I at least have observed that neurasthenia is seldom found in those circles where there are many very strongly excitable egos which cannot be easily re-

pressed, therefore among artists and artistically gifted nations.

Only think of the Italians. What noise, what activity, passionate in sorrow and joy! But no nervousness. But the less passionate Northerners are nervous. That is so clear that it can be found pointedly set forth in literature. How morbid, how pathological do we often find the contents of the modern northern fine writing, and how different the books of the Southerner! How healthy are these, notwithstanding the passion and the tragic! The Italians need alcohol much less than we do, and still opposition to alcohol hardly takes any root in the Latin countries.

Men have really known all this for a long time, and they therefore like to meet after the labour and burden of the day over a glass of alcoholic beverage. It is so agreeable to them if the ego excited by alcohol changes the lever of the brake and by so doing allows thinking, feeling, and observation, like obedient locomotives, to run on the tracks upon which each would always like to travel if he could do as he wished. Those who examine the conditions more deeply will observe that the glass of wine, taken judiciously, after the day's work,

means not only a subjective benefit but the introduction of a correction very important for the health of our nervous life. It is no luxury, it is a necessity, a nervous hygienic measure of the highest importance.

VII

RESPIRATORY AND NERVOUS CENTRES

The centre for respiration and the nervous centre for the vessels are central nervous apparatuses situated in the so-called medulla oblongata, of which the one regulates respiration, the other the distribution of the blood in the organism. The influence of alcohol upon these cannot be discussed with great brevity.

We can dispose of the action of the centre of respiration the more easily. A noxious influence of alcohol upon it has never been demonstrated, except as regards the man who gets dead drunk. On the contrary, this centre will generally be found somewhat excited by the judicious use of alcohol, even in intoxication, but not paralysed [28]. But it is influenced from all possible sides on account of its many anatomical connections. It is therefore naturally not easy to decide whether the alcohol used has a direct influence or whether

other circumstances produced by alcohol induce the stimulation of the centre of respiration, which is undoubtedly present.

Much could be said on this point. Only one thing is true: As often as anybody has tried to prove by experiments that there is no direct influence of alcohol, he has failed. On account of this and because it speaks in favour of the view that the direct influence of alcohol in exciting the centre of respiration is shown, not only during exaltation, but also during intoxication [28], I side with the authorities who accept the theory of a direct exciting influence of alcohol upon the centre of respiration.

Practically the discussion is of no importance. Here it matters only that this centre, so important for life, is excited by the use of alcohol. And that is always the case with the sensible alcoholist, even if he should occasionally become intoxicated. That is all we need to know.

The conditions are more complicated with the nervous centre of the vessels. I must speak of this more explicitly. Not only is this point more unfamiliar to the public and of more practical importance, but scientific

investigations within the last fifteen years in this field have discovered conditions which, among other things, cause the influence of alcohol upon the distribution of the blood in the organism (which influence alcohol possesses on account of this effect upon the nervous centre of the vessels) to appear in an entirely new light.

First of all I shall explain to the reader the real physiological conditions (29). The results of numerous investigations force us to accept the theory of the existence in the medulla oblongata of a general nervous centre for the vessels which regulates the blood distribution in the whole body. It consists of at least two apparatuses, one which contracts the vessels and another which dilates them. From both apparatuses there proceed nerves: the vasoconstrictors and the vasodilators.

If the vasoconstrictor apparatus is excited, the impulse will go through the vasoconstrictor nerves to the nervous terminal organs, situated in the muscles which surround the blood-vessels like a ring. If the impulse arrives there, the annular muscles of the vessels contract; the ring becomes narrower, and with it the vessel. The region in question be-

comes therefore anæmic, because a narrow vessel contains less blood. If the region is the face, it will appear pale.

If the vasodilator apparatus is excited, the impulse travels through the vasodilator nerves, but not to the vessels themselves, but only to certain stations interposed in the nerve plexuses, stations through which the vasoconstrictors also have to pass before they reach the muscles of the blood-vessels. If an impulse passing along the vasodilators reaches these stations, the result will be that they are closed for impulses carried by the vasoconstrictors. Now, no impulse will get to the blood-vessels in question which would induce the circular fibres to contract. The muscular ring relaxes, becomes enlarged, and with it the vessel. The wide vessel contains more blood, the region becomes full of blood; if it is the face, it becomes red.

So long as we live, these two apparatuses of the general nervous centre of the vessels perform their function in the medulla oblongata, but not exactly in the same manner. However, they work wonderfully hand in hand. If the vasoconstrictor apparatus contracts the vessels in one region of the body, the dilating

apparatus dilates them in another. It has been shown that the surface of the body (skin) and that of the brain on the one side, and the intestine in the inside of the body on the other side, work together. Therefore, if the general nervous centre for the vessels is healthy and is especially excited, the usual result will be (the investigated cases are very numerous) that either the vessels of the skin will be enlarged and the intestinal vessels contracted or *vice versa.*

The importance of this hand in hand working of the two apparatuses of which the general nervous centre for the vessels consists can easily be seen. What would otherwise become of our heart? As soon as we go into the cold our cutaneous vessels become narrowed, not because the cold directly influences the vessels of the skin, but because the influence of cold is conducted by the nerves of temperature to the nervous centre for the vessels, and stimulates that in a particular manner (see below). If the vessels of the intestines did not dilate at the same time, where should our heart throw the blood? As our intestinal vessels become enlarged at the same time, the heart can throw into them what cannot go to the skin.

If we go into the warmth, our cutaneous vessels become enlarged by the intervention of the nerves of temperature. As the intestinal vessels become narrow at the same time, our heart receives from them the necessary blood to fill the dilated vessels of the skin. Without the sensible arrangement of this complex machinery, called the nervous centre for vessels, our heart would soon be demolished.

One can easily understand how by a simple throwing of the lever of this machine all of a sudden the distribution of the blood in the body is changed. If the machine is set to " external wide, internal narrow," the skin will be full of blood, while the internal organs are anæmic. If the machine is set to " external narrow, internal wide," the skin will be anæmic while the intestines are congested. If now we ask ourselves what changes the lever of the machine, the answer will be: All kinds of influences, nervous influences and chemical substances which are carried with the circulating blood to the machine.

This nervous machine is also connected with different parts of the nervous system. One will understand that such affections as excitation of the sensory nerves of the skin, etc.,

may influence its activity. Severe fright places the machine "external narrow, internal wide," and one becomes pale from fright. The temperature nerves of the skin place it "external narrow, internal wide" (irritation of cold) or "external wide, internal narrow" (irritation of warmth.)

Among the chemical substances which influence the machine the caffeine of coffee and tea throws the lever to "external narrow, internal wide," skin anæmic, intestines congested. Certain so-called convulsive poisons throw it to "external wide, internal narrow," dilated vessels of the skin, entirely anæmic intestines [30], etc.

That is the general picture of the influence of the central nervous system upon the blood-vessels, which influence does not exclude external influences. An inflamed region of the skin remains red even if the irritation of cold renders the other vessels of the skin anæmic by making them narrow. In the act of digestion the vessels of the stomach may be wide while the vessels of the intestines are narrow. But those are only local conditions which have nothing to do with the nervous centre for the vessels in the central nervous system.

The great advance over former times does not wholly consist in our, only now, better understanding of the whole distribution of blood in the body and its regulation through the central nervous system, but also in our explanation of the dilatation of the blood-vessels in certain circumscribed regions of the body. While we formerly explained these dilatations of the blood-vessels, which occur often through the nervous centre of the vessels, on the entirely unphysiological idea of partial paralysis of one and the same centre, we know now that it is only a suspension of the centre in one certain sense—that both apparatuses are in activity and that nothing is paralysed.

On the other hand, we know through these investigations that if a substance ingested produces by its influence upon the nervous centre for the vessels, among other things, dilatation of the blood-vessels in a certain region of the body, especially if this region is the skin or the surface of the brain, the effect is not to be looked upon as a paralysis, but as a kind of excitation of the nervous centre for the vessels. Thus we have again come to the special influence produced by our alcohol upon the nervous centre for the vessels.

If one asks how this is shown, he will be told that it is through a dilatation of the vessels of the skin and perhaps of the surface of the brain. If one inquires about the vessels of the inside of the body, a deep silence is the answer.[1] We must therefore interrogate other circumstances and logic.

Two things are immediately plain. 1. The dilatation of the vessels of the surface of the body produced by alcohol has not its origin in the fact that the alcohol circulating in the blood directly influences the walls of the vessels through which it flows. 2. The dilatation of the vessels of the surface of the body does not correspond to a simultaneous enlargement of the intestinal vessels, as would happen in a paralysis of the nervous centre for the vessels. If one of the two occurrences should take place, the blood pressure would sink consider-

[1] *Noted during printing.* In the meantime the experiments of M. Kochmann have well supplemented my statement, which I had, in writing my book, to deduce logically from other physiological facts. This author also reaches the conclusion through positive results of his experiments that in at least the moderate use of alcohol the dilatation of the vessels of the skin corresponds in time to the constriction of the vessels of the intestines. Compare: *Zentralblatt für Physiologie*, November 4, 1905, where the original is cited. As his work came to my notice through that number of the *Zentralblatt*, I could not make use of it while writing the text.

ably after one glass of wine (which is enough to produce an enlargement of the vessels of the skin), the heart would not receive enough blood, in short, disagreeable and remarkable accidents would occur which in reality have never been observed. (If alcohol exerted in this way a direct influence upon the vessels, the whole body would feel the influence, the vessels of the intestines would become enlarged, and the dangerous condition which we have mentioned would appear. But this is never the case.)

We therefore have as a result of the judicious use of alcohol dilatation of the vessels of the skin (also of those of the surface of the brain), together with a constriction of the intestinal vessels. That is a well-known typical case of placing the nervous centre for the vessels upon "external wide, internal narrow." Alcohol, like all other chemical and non-chemical substances, produces an excitation of the nervous centre for the vessels in a certain manner, but not a paralysis.

And so we find the important centres of the medulla oblongata excited during the sensible use of alcohol. Our respiration is deep, and the vessels of the intestines are anæmic (it is

only by a local influence that alcohol during its presence dilates the vessels of the stomach; this has nothing to do with the rest of the question).

As regards the consequences of these alcoholic influences, the data concerning the blood pressure vary greatly. In one part it is somewhat lowered, in another raised; *in toto* the changes are not great. It can be seen from these differences that alcohol has not much to do with it. And that is only natural according to our previous statements. Often and rightly the conditions of the blood pressure are held to depend partly upon the phychic excitation produced by alcohol. The whole business is practically and scientifically of no interest, as moderate fluctuations of the blood pressure are entirely indifferent for our health (such fluctuations exist on standing and lying down). We do not know what produces them. Immense fluctuations of the blood pressure are of diagnostic value, but they are here entirely lacking.[1]

Because alcohol produces dilatation of the vessels of the surface of the body, we therefore

[1] M. Kochmann observed sometimes during the temperate use a pretty strong increase of blood pressure.—*Loco citato.*

give off more heat, the blood circulating in greater quantity near the outside air loses more heat externally. The temperature of our body must therefore fall. And that is really the case in a very small measure, *i. e.*, with the sensible use of alcohol and when the body is clothed, 0.1° to 0.2° C. [31], practically an absolutely unimportant temperature reduction, as in normal life much greater fluctuation takes place without alcohol. We must only remember that the alcohol restores the surplus of the heat given off to the outside through the skin by forming in the body heat by its combustion. Besides, we are usually dressed when we drink alcohol. All these are details of no importance for our well-being.

Only one point seems to me of importance. I mean the manner in which alcohol distributes the blood within us. It causes so much blood to stay at the surface that the intestines are relieved of blood. Its influence is therefore opposite to that of coffee or tea, which burden the intestinal organs with blood and free the skin from it. These are very important facts in practice. Not only the physician must take them into consideration, but also a sedentary person, and ailing women should always re-

member these statements and use them in their hygiene of nutrition. I also refer to the medical part.

Résumé of the last three chapters.—What is the effect of the regular and judicious use of alcohol? Answer: Excitation of the nerves of taste and smell, excitation of the secretory nerves of the glands of digestion, excitation of the centre of respiration and of the general nervous centre for the vessels, and psychic excitation.

Practically expressed: We feel ourselves internally inspired—this inspiration checks our nervous excitability, which, increased, would be disagreeably perceptible; it looks out for the change of perception, feeling, and thinking, which is not only agreeable to the brain of the professional man, but sometimes directly necessary; at the same time we breath well and deep, the skin is agreeably warm, our intestines are adequately unburdened of blood, the digestion is faultless, and the heart beats full and strong. All this is favourable and important excitation and its sequence.

VIII

THE OCCASIONAL IMMODERATE USE OF ALCOHOL (INTOXICATION, NARCOSIS, "ACUTE ALCOHOL POISONING")

I HAVE given to the last chapter an especially large space on account of its very great practical importance.

The rest of our investigations can be reported much more briefly. I hope I shall interest the reader enough when I speak of isolated intoxication to justify my somewhat detailed description. We shall bring forward points which seem to have been forgotten even by the specialists.

Everybody knows that we become intoxicated if in imbibing alcoholic beverages we greatly transgress our usual quantity. That differs from the regular and sensible use of alcohol in that, instead of a "stimulation," we have an "intoxication," which finally, if we

continue with the drinking of alcohol, turns into "stupefaction." If the use of alcohol is only somewhat larger than the usual amount, this stupefaction will not appear; the intoxication remains in a certain degree, and one is "exhilarated."

We therefore see from the experience of centuries that the consequence of the casual immoderate use of alcohol is not only a "stupefaction," or a simple narcosis, but a complicated condition. Contemplation teaches us that an intoxicated person is not the same as a stupefied person. The fact also teaches that there are substances which stupefy and do not intoxicate, for example, our medicinal narcotics.

If I take chloral hydrate, I shall, in a quarter of an hour, become drowsy and fall asleep. If I take much of the remedy, the sleep may change into complete unconsciousness: I am then entirely insensible, my muscles are flaccid, the reflexes are extinguished, and only the never tiring centres of the medulla oblongata, in the first line the centre of respiration, perform their work. It is therefore a real stupefaction which can be carried from the lightest to the severest stage without passing through a stage of intoxication.

That "narcosis," "stupefaction," is not the same as "intoxication" is shown by a narcosis normally produced daily by nature, sleep. The existence of sleep should really teach man that it is no great reproach to a remedy if it "stupefies" us. If it does nothing else, one may ask whether it would be right to call it a poison only on this account. Then it produces nothing but what is produced by the fatigue products which, we are told, are formed by ourselves while working and which are the cause of sleep according to the opinions of many specialists [32]. The greatly exaggerated dread of all stupefying remedies has absolutely no scientific basis.

Sleep is an ordinary stupefaction which can vary according to its depth. We find after an extraordinary performance of muscular labour sleep which hardly differs from unconsciousness. One cannot be aroused, is nearly insensible, the reflex excitability is greatly diminished (in contrast to light sleep, where it is augmented as in every light narcosis), the muscles are flaccid, etc. The reason why we cannot produce with the narcosis of sleep such a complete paralysis of the central nervous system as with artificial remedies is the fact

that in the latter we can regulate the quantity of the remedy according to our wishes, a statement which can be made of the formation of fatigue products only in a modified manner. Sleep and narcotics prove clearly that intoxication is not the *sine qua non* for the ensuing stupefaction, for which it is not even necessary. On the contrary, when it is present it very often impedes the progress of stupefaction.

Alcohol produces, if used in excess, first intoxication, later stupefaction; it can therefore not possibly be simply a stupefying substance, merely a paralysing one; that which only paralyses can never produce an intoxication. The absolute preliminary condition for this is the fact that the substance in question must intensely excite us psychically. And this leads directly to the following:

There is first a psychic excitation from the immoderate use of alcohol, which again is aggravated beyond the normal. Man is then not only stimulated, he is excited. But to this psychic excitation is joined a stupefaction, that is, a paralysis of, first, the organs of the so-called external psychic life.

I include under this expression the so-called functions of the cerebrum, the apparatuses of percep-

tion, imagination, and association of ideas. They are certainly active in the excitation of our inner personality, which uses them as its assistants. But everybody knows that we very often perform labour with these cerebral functions without the participation of our inner personality. We then speak, as is well known, of the mere external intelligence. We are well aware of the distinction in our psychic life, and the term external psychic life is justified. With the judicious use of alcohol there is only exaltation but with its immoderate use there is a mixture of phenomena to which we shall now devote our attention. It is the same with alcohol as with many other substances. The stimulating action does not affect all the cerebral functions at once, but only some of them. And, in the second place, it is true of alcohol, as of all substances that paralyse (no matter whether they paralyse at once or only when certain large amounts have been taken), that the paralysing influence is not exerted simultaneously upon all the functions of the brain, but at first only on a few of them.

If, now, a substance which first excites and then paralyses influences in the stage of excitation another brain function than in the stage of paralysis, we understand at once the positive fact that in the increasing use of such a substance an intermediate stage will appear in which the remedy will in a certain region, where it stimulates, still excite, while in another region, where it begins with the paralysis, it already paralyses.

Such an intermediate stage is "intoxication." The substance which first excites and then paralyses may only be such a one as especially excites the field of inner psychic life, but which, when in consequence of an increasing quantity paralysis begins, excites the field of external psychic life, especially the brain functions of conscious observation of the external world. Intoxication begins at the moment when the paralysis of external psychic life starts, while the excitation in the field of the inner psychic life still exists and is even progressing. Certainly alcohol is such a substance. We know that it excites our inner psychic life.

a. If it is used in increasing quantities the stimulation increases to excitation. Therefore there occurs such a variety of symptoms into the intoxicated. The excited ego accelerates imagination and reasoning, an irrepressible desire to live to its limits appears. Joyfulness is manifested in the sanguine, rage in the choleric, crying in the melancholic; the agreeable one becomes more agreeable, the quarrelsome one unpleasantly quarrelsome; whether the condition is pleasant or disagreeable depends upon the individuality of the ex-

cited ego and the degree of intoxication. To this there is now added: *b*. The beginning of paralysis in the field of the external psychic life. It is a certain cloudiness of the perception of the outer world if it is a minimal "jollity." In a severer paralysis the whole power of perception is dim. The intoxicated man is uncertain not only about his whereabouts, but also about the psychic happenings. If it goes still deeper (partly during the severer clouding process of the perceptive power) it attacks the apparatus of association; the intoxicated man talks incoherently. And so it goes on until perception, imagination, etc., are entirely paralysed. Then sleep comes on. The intoxication has now reached the stage of entire stupefaction.

But the excitation in the region of inner psychic life still remains during the entire progress from cloudiness of conscious perception of the outer world to the appearance of sleep. During the whole time the excited ego predominates over the external psychic functions, perception, imagination, and reasoning. And on account of this, although the psychic functions gradually become more incapable of performing their duty, the typical picture of

intoxication comes out in all its degrees from its beginning, when the man is no longer entirely clear about his environments, where he lets his excited ego act as it pleases, until the stage preceding sleep, where then the excited ego can only show itself, on account of the nearly absolute failure of perception, imagination, and reasoning, in the form of its basic principles, instinct together with the corresponding impulsive actions.[1]

The intoxication is therefore an inner psychic excitation with dimmed consciousness. Here also there is a diminution of the excitability towards external influences, as the consciousness is clouded, but this is now an entirely different condition from the one formerly described as a sequence of stimulation.

We used the example of a painter, only inspired by wine. He showed there only a change in his excitability by external impressions, because he now mainly observed the pictorial side of everything, and other sides less or not at all. At the same time his observation as a function of the brain worked in perfect order, but it acted only upon certain

[1] These conditions explain at the same time the violent acts committed during inebriation if the ego in question was by nature endowed with the necessary disagreeable gift,

things. His consciousness as such was entirely clear.

Let us now take the example of an inebriated artist. He also will, on account of the excitation of his psychic personality, observe only the artistic side of the outer world, but this also is no longer clear. Thus originate works which show the genius, but do not appeal to the man of healthy feelings.

If we take the poet instead of the painter, history will give us a similar comparison: Schiller and Grabbe. One will observe plainly how differently, though with almost identical genius, the inspired dramatist (Schiller) worked compared with the other, who became intoxicated (Grabbe.) Grabbe produced everything that the genial dramatic ego, even with clouded external psychic functions, could produce; the immense ideas, the strength of feeling, the power and reality of the picture. But everything which must be at the service of the inspired, even excited ego, was missing in Grabbe. Therefore the incongruity of his works, the uncertainty, the practical impossibility of producing his dramas on the stage. In him is also very clearly defined the over-excitation of the inner psychic

ego already existing during the dimness prevailing in the region of the external psychic ego. Inspiration is turned into sentimentality, satire into cynicism, expressions and pictures cannot be strong enough.[1]

I therefore think that hardly anybody can ever confound inspiration, *i. e.*, psychic inner excitation with entirely clear consciousness, with intoxication, *i. e.*, inner psychic over-excitation, agitation, with dimness already appearing in the region of the external psychical life.

If the immoderate use of alcohol is carried to the extreme, real unconsciousness will finally appear. The paralysis in the central nervous system overshadows that of the cerebral functions, just as occurs in normal sleep, which, when it has reached a certain depth, is not only a paralysis of the organs of consciousness, but a more extensive paralysis of the central nervous system. The simultaneously existing inner psychic excitation stops the progress of the stupefaction in the intoxicated man. In the beginning it may also hide the dimming of consciousness for a while.

[1] Goethe wrote *Faust*, Byron, *Don Juan*. Grabbe was not satisfied with one; he wrote *Don Juan* and *Faust*.

The matter stands thus: Every stupefaction —it does not matter whether it is produced by a substance artificially introduced into the body or whether it is a normal stupefaction, called by us sleep—is not a complete one immediately. It has, indeed, a starting point, it begins with the diminution of the perception of the outer world. Every stupefaction begins thus. But the general perception is not yet paralysed; we may in this condition observe many things. The best known example of this is the normal dream. It is therefore not to be wondered at that in the first stage of alcoholic intoxication only the perception of the happenings of the outer world is conspicuously diminished, and that the intoxicated man still continues to show an animated condition. The excited inner personality does not allow the consciousness to rest, as in the dream. In like manner, but much stronger than in the dream, because especially excited by alcohol, the excited inner personality fills the consciousness with many perceptions and imaginings, although the clear, conscious observation of at least a certain part of the outer world will disappear more and more with the increase of the intoxication. This observa-

tion is necessary for the direction and control of our psychic inner life. From this it will be understood why the senseless, disconnected imagination appears so often during intoxication and the dream.

The normal dream banishes normal sleep only then when it becomes too vivid (in the most excited moment one awakes), when our inner psychic processes appear to the consciousness and suspend sleep. Similar to this is the action of alcohol. The inner psychic actions, which appear intensively in consciousness by reason of the alcohol excitation, suspend the alcohol narcosis and retard the occurrence of complete stupefaction.

On account of this, the duration of the stage of intoxication, during inebriation, depends very much upon the psychic excitation of the person in question. In the bilious it takes much longer than in the phlegmatic to arrive by intoxication at the stage of sleep. Here we come to the differences existing in the intoxicated. We shall understand these immediately on account of the preceding explanations.

The behaviour of an intoxicated person depends first upon the special original condi-

tion of his personal ego, which may, when excited in the first stage of intoxication, act more frantically. I do not think it is necessary for us to explain this. To this is now to be added the excitability of the ego. We have just mentioned that upon it depends the duration of the stage of intoxication. The more excitable the inner personality—bilious or sanguine—the longer its duration. The first one to fall asleep is the intoxicated phlegmatic. I wish to add here that the difference produced by temperament shows itself well even in a child. I remember a girl of about eight years, of very lively temperament, who, being intoxicated from a very pure alcoholic beverage, had to pass through a very long and vivid stage of intoxication before she fell asleep.

As a third point there is to be added to the foregoing the quantity of alcohol to which the person in question is accustomed. Here we shall have to stop for a moment. We need not discuss very explicitly the fact of getting used to all kinds of substances (the consumer of wheat bread will have to get accustomed to rye bread, and *vice versa*), but one can state at once that there are only a few instances of

acquired toleration so pronounced as the cases of toleration of the psychic functions for certain stupefying substances. That holds good, too, of the fatigue products formed normally in us. Not only is it well known that one can get accustomed to staying up late at night, but we also know that a regular routine of daily increased muscular labour (the muscles are considered as the principal producers of the fatigue substances which result in sleep) does in time fail to produce sleep so easily as in the beginning. Furthermore, this is also the case with the ordinary medicinal narcotics. Especially is it true of substances which not only have a stupefying influence, but cause also an excitation of the inner psychic personality. For these especially the toleration is most clearly defined. It is a fact that one has in time to take constantly increasing quantities if one wishes to stupefy himself. Especially for these substances (and alcohol belongs to them) the habit is most quickly acquired. It is very probable that this has a direct connection with their quality of being at the same time an excitant of the inner psychic personality. I cannot explain this more explicitly here.

According to the purpose for which alcohol is used will this be agreeable or disagreeable. If alcohol is drunk for stimulation, it will be agreeable; one can produce this permanently and clearly without at the same time running the risk of partly paralysing one's external psychic functions. But if alcohol is drunk for stupefaction, it is very disagreeable, as one has always to increase the amount, and by doing so one will eventually ruin himself.

The man who really enjoys life, who drinks alcohol only on account of the stimulation, will drink it very judiciously, but also very regularly. We also know that moderation and regularity constitute, without exception, the only sensible way of consuming any substance. In this manner only does one receive stimulation alone from alcohol.

If the question refers to "the becoming intoxicated," and to the duration of the stage of intoxication, then habit plays a certain rôle. I shall now summarise the cases which are likely to occur.

1. If persons who are absolutely unaccustomed to alcohol indulge in drink, they will soon arrive at the stage of drunkenness, which is speedily followed by sleep (those of less

excitable inner personality, the phlegmatic), or the stage of inebriation will be much more pronounced and extend over a relatively longer period, that is, it will not be followed so soon by sleep (persons of very excitable inner personality, the bilious, and the sanguine).

2. In persons who are accustomed to a sensible and regular use of alcohol, if they become intoxicated, the stage of drunkenness will generally appear later. They must not only absorb their accustomed quantity, but they must also overstep it by a great deal before they arrive at the stage of drunkenness. Afterwards the stage of drunkenness is of longer duration, because at first the stupefaction progresses much more slowly, for the reason that at its beginning the person in question was in a much more pronounced state of psychical excitation. This excitation impedes the stupefaction, as has been said before.

To all this must yet be added the special, individual, pre-existing excitability of the psychic personality. If it is in itself a strong one, the stage in inebriation will be additionally prolonged.

A bilious person accustomed to a certain amount of alcohol will therefore show an

especially prolonged stage of drunkenness before he falls asleep, unless he immediately consumes enormous quantities of alcohol all at once. In this case he will certainly reach the stage of drunkenness much quicker. But here I am considering only the cases in which the usually judicious alcoholist drinks on an occasion somewhat injudiciously.

Again we see, then, that the differences which are shown when an ordinarily sensible person gets drunk can only be explained by the fact that alcohol here, too, maintains its important rôle as a psychic excitant, although stupefaction of the so-called functions of the cerebrum (which are the external psychic functions) appears here also.

We still have before us the question of whether the excitation of the intoxicated, which nobody can deny, does not at first appear in an indirect way. Is it not at least a sequence of a cloudiness of the consciousness, produced at the same time, that is, a sequence of the paralysis in the field of external psychic life? [33.]

This question is of importance in so far as, in consequence of the paralysis, our perceptive life becomes more or less disordered or disar-

ranged. Therefore we must investigate as to whether this last circumstance does not again produce excitation by itself.

The answer is that we are never excited because our perceptions are disordered. If this were the case, we should always be excited when our perceptions became disordered. Experience speaks against this. Not only is there sometimes a terrible derangement of perception in the insane without their being at the same time excited in any way—I have observed this myself—but we ourselves every day experience normally a disorder of perception without any special excitation,—I mean during the time of falling asleep. The same also happens if we stupefy ourselves with a narcotic.

We can even allege still more. The condition of a sleeping but dreaming person demonstrates that even the severest derangement of perception does not excite *per se*. Often we do not awake when we dream the most foolish dreams, but we often awake only after dreams in which there are order and logic, so that one imagines that it was reality and not a dream. It, therefore, does not depend upon the degree of derangement of our

perceptions, but upon the degree of inner psychic excitation whether a dream greatly excites us.

These facts are sufficient to make it comprehensible that the excitement of the intoxicated absolutely does not depend upon disorder of the perception. It can therefore be only a direct effect of the alcohol, which, by excitation of our inner personality, becomes a cause of intoxication.

Result: If a man gets drunk, the excitation of the inner psychic personality produced by alcohol increases on the one hand, while on the other hand the stupefaction or the paralysis of the external psychic life begins when a certain amount of alcohol has been taken.

If a man still continues to drink the paralysis of the external psychic functions (perception, etc.) becomes continually more complete and the inner psychic excitation loses more and more the faculty of expression. During this stage there very often exists a restless sleep. If the quantity of alcohol consumed was especially large, the paralysis gradually attacks the entire brain and even other parts of the central nervous system. Unconsciousness now exists.

Because the paralysis in this later stage attacks other parts of the central nervous system, other phenomena of the before-mentioned important nervous centres of the medulla oblongata will be joined to the complete unconsciousness. For example, the general centre for the vessels may become paralysed all of a sudden; then all the vessels of the body will be dilated, the blood pressure will go down considerably, and the heart-beats will become slower, because after every systole it takes some time for the heart to fill again. The pulse is feeble. The person must be very drunk indeed if these conditions appear.

The respiratory centre holds out the longest, and the cases in which an adult becomes so drunk that finally that centre is paralysed are very few. That stands to reason. On the one hand, an enormous quantity of alcohol is necessary to produce such a condition in the adult, while on the other hand the drinker, almost without exception, has long been incapable of drinking anything more before the amount of alcohol consumed is enough to paralyse the respiratory centre. In these cases the stupefaction itself, which appears much earlier, protects the man against the possibility

of taking such doses of alcohol as would endanger life.

If that really should occur, it will happen only to an habitual drunkard or to children who, for example, discover a bottle of brandy and empty it. In such cases paralysis of the respiratory centre sometimes takes place, and with it death. But such accidents are absolutely unimportant in judging about the use of alcohol.

IX

THE HABITUAL IMMODERATE USE OF ALCOHOL (IMMODERATE DRINKING, DRUNKENNESS, CHRONIC ALCOHOL POISONING)

We have already repeatedly mentioned that the drinker differs from the sensible alcoholist in the fact that he does not drink merely to stimulate himself. With him the end intended is clearly at least a certain stupefaction. Whoever looks for this will usually find among the substances available for this purpose in our country only alcohol in the form of alcoholic beverages, on which account alcohol is thus used by many people. Whether it is very well adapted to this purpose is another question. Observation has shown us that the nations that possess besides alcoholic beverages other stronger stupefying substances, which are readily available, usually prefer these to attain their end.

Alcohol possesses, as has been stated, like

other narcotics, the property that man easily becomes accustomed to it. He who looks for stupefaction must use always larger quantities of alcohol, too, that he may attain his end, and in this manner he arrives at the regular and excessive use of alcohol.

All this is so intimately connected and so well known that it is not necessary to waste any more words upon it. But the following is another question: Does the drinker really attain his object in the long run? The answer is: No, not in the long run; the longer he drinks the less he attains it. This does not by any means escape the drinker. Consequently he uses always larger amounts, always stronger alcoholic beverages, until finally as a rule he uses those containing fusel oil, because in time alcohol itself, ethyl alcohol, can no longer satisfy his desires.

Neither does it escape the relatives of the drinker; they suffer much less so long as alcohol stupefies him. Their martyrdom usually really begins only when he is no longer very successful in obtaining stupefaction and when the condition of excitation produced by alcohol predominates in the picture of his inner psychic life.

Indeed it would not always be the worst for his surroundings if the drinker would only become stupefied, paralysed, for then he would only sleep a great deal and would not hinder his wife in attending to her household duties, in educating the children, etc. But, alas, such is not the case. And especially the explosions of the inner excitation make the situation most difficult, the raging, the shouting, the violence, the ill-treatment of relations, the destruction of property, the breaking forth of excited instincts (sexual attacks), etc.

And here, too, and that is the first reason why we dwell upon it now, one must take into consideration that alcohol is an excitant for the inner psychic life. This especially is of the greatest practical importance. And here also the discussion is of an excitation directly produced by alcohol, and not about a sequence of, perhaps, a stupefaction, as these conditions of excitation just here come to the front when the person in question is so much used to alcohol that even immense quantities of it no longer produce complete stupefaction.

Certainly everything is here entirely abnormal. The inner psychic excitation has long ago become an agitation and the apparatuses

of external psychic life (perception, combination of ideas, etc.) no longer so easily completely paralysed, but only partially. But this incomplete paralysis affects only such central nervous apparatuses as are already more or less ruined by continuous immoderate drinking.

If the habitual drinker gets drunk, he shows the picture of an organism which has become the prey of a more or less wild inner agitation. His faculties, if they are called upon to act externally, have at their disposal only more or less destroyed apparatuses of observation and imagination. The more thoroughly this is the case the less can the inner excitation express itself in what we call "thinking," the more does it show itself in the form of only affective or instinctive manifestations. And, as this kind of manifestation is an attribute of animals, we have for centuries rightly said that the habitual toper finally came to resemble an animal more and more.

Indeed—and that must not be forgotten if we do not wish to be guilty of exaggeration—that is only the final stage of the toper. There are immense differences in all the lighter cases which are dependent upon the individual inner

psychic qualities of the person in question. Here, too, it makes a great difference whether a gifted man imbibes or one who is normally nothing more than a simple creature of instinct in his inner psychic life.

On the whole, there is to be seen an unmistakable similarity of these conditions to what we have already depicted in reference to intoxication. Although this is easily explained, one must, on the other hand, not overlook the unquestionably existing differences, which cannot be overcome, if one wishes to avoid mistakes. First, what there appears isolated is here chronic. Furthermore, the stage of intoxication is here, on account of habit, changed with more difficulty into the stage of unconsciousness. And, thirdly, and that is the most important, the question is here no longer about only temporarily paralysed apparatuses of external life, but about those that are more or less ruined.

A ruined brain cell is something entirely different from one that is temporarily paralysed. This point forms the second reason for here investigating more closely the condition of the drunkard, especially as these matters are continually confounded. Naturally a ruined

brain cell is something abnormal. The question of whether a temporarily paralysed cell of the brain already signifies something abnormal or whether it is not perhaps only a functional change, normally occurring constantly, a change similar to the one we experience in normal sleep, cannot be so easily determined.

If we now examine the condition of the brain of the drunkard in reference to this fundamentally very important difference, we shall find decidedly different kinds of changes, some of which will cease with the discontinuance of the drinking habit, and others which even then will still continue to exist. If, for example, a toper is brought into a sanatorium where he must immediately begin to live abstinently, he will usually soon become quiet; even if now and then some relapses occur, the excitation will very soon and considerably be toned down. We must attribute the excitation to a change in the nervous system, which was also affected by the alcohol, but which cannot consist in profound changes in the brain, as otherwise they would not disappear so quickly.

Referring now to the apparatuses of exter-

nal psychic life (perception, imagination, combination of perceptions) the result of the ensuing abstinence from alcohol depends upon the duration and strength of the pre-existing drink habit, especially upon the degree in which the use of fusel oil was connected with it. The subsequent abstinence of a former habitual drinker of spirit containing fusel oil will obliterate the excitation, but not the stupidity.

Therefore the mechanism of the external psychic apparatus will then become normal in consequence of abstinence from alcohol only if the tippling was not very great, did not extend over too long a period, if the person in question used only the best alcoholic beverages, and if he is (a fact which is more rarely the case than is usually accepted) naturally of entirely sound mind.

In all other cases something will remain. We find even in the regular injudicious use of alcohol two entirely different changes in the brain—those which correspond to brain elements destroyed by alcohol, and others which correspond to brain elements changed during the period of tippling but not destroyed. The proportion in which both exist always depends upon the seriousness of the case.

Such are the conditions with the drunkard. Let us now compare the brain of a man who gets drunk only once in a while, during a yearly fair, for example, but at other times uses alcohol sensibly. Here there is no longer anything to be said of destroyed elements of the central nervous system. Here are exclusively only such changes of the brain elements produced by alcohol as disappear very soon without leaving any trace.

He who becomes drunk from good wine sleeps it off, and the whole affair is ended.[1]

Without question there exists a fundamen-

[1] Perhaps the reader will miss a description of the so-called Katzenjammer (the headache of the morning after). The author has pondered a great deal about this point and has collected many observations in life. But he has always come to the result that here, too, alcohol does not play the rôle which is ascribed to it. Otherwise an alcoholic beverage would not agree with one and the same person although it is taken in greater quantity than another, containing less alcohol, which when taken even in smaller quantities, produces Katzenjammer. For this condition the composition of alcoholic beverages is principally of importance, not taking into consideration the individual difference. It is well known that one and the same Moselle wine, taken pure, agrees with us very well, while, taken in the form of a more or less complicated punch, it very often has disagreeable after effects. Besides, we must also take into consideration the entire external surroundings under which alcohol is often drunk (much talking, in poor, smoky air, etc.) and especially the fact that a great deal of Katzenjammer is only exhaustion from a sleepless night.

tal difference between the brain of a drunkard and the brain of a sensible alcoholist, even if the latter should once in a while become drunk. If the latter snores once in a while during his intoxication, there is, notwithstanding this, nothing as yet destroyed in his brain, but it is only a temporary suspension of certain functions of the brain. After half a day, at the latest twenty-four hours, everything will have disappeared.

Now comes the most important part. Anyhow, have we a right to designate as a disturbance the temporary suspension of the brain function which we call the external psychic life (perception, imagination, combination of perceptions) as shown in one who gets drunk only occasionally? Is not that in reality only such a change of the brain function as will otherwise often occur normally, even must occur? Does the stupefaction, *i.e.*, the suspension of consciousness, signify a disturbance at all? Does not in this respect the stupefaction produce the same effect as the fatigue products or other causes which produce our "normal sleep"?

We shall investigate this question from this

side also, from which a number of specialists have also viewed it for years [32].

It is self-evident that no severe change of any kind of the several elements of the central nervous system forms the base of the paralysis which we call stupefaction, narcosis. Nobody would dare to prescribe a narcotic and nobody would dare to chloroform a patient for an operation, if the specialist had not known this for a long time. Chloroform has a much more energetic paralysing effect upon the central nervous system than alcohol, and still we know absolutely—I myself from my own large experience—that the deepest chloroform narcosis, during which almost the whole central nervous system with the exception of the respiratory centre is entirely paralysed, will soon disappear absolutely without a trace.

Of how little import must therefore be the changes in the brain cells in question, notwithstanding the great impression upon the spectator! How must they be analogous to the changes which we experience during normal sleep!

On the other hand, normal sleep, which today is often called autonarcosis by the special-

ists (according to whose theory the organism narcotises itself by means of the fatigue products formed by itself), shows us, not only that our brain apparatuses which serve the purposes of external psychic life are arranged to become temporarily paralysed, but that this "change of condition" is absolutely necessary from time to time for our health.

Sleep unquestionably belongs to the normal functions of the brain apparatuses with which we are now dealing. Nobody can deny that during sleep the functions of our external psychic life are paralysed. It is also certain that sleep, according to the degree of its profundity, follows the same course as does stupefaction produced by special means; first the perception of the outer world is suspended, then that of the inner world, and finally the reflex excitability, in the beginning increased, becomes less, etc.

We are therefore forced to come to the conclusion that temporary paralysis of the organs of external psychic life, stupefaction, or sleep, does not mean an interruption of the brain functions in question, but a functional change which is limited to entirely normal conditions, which appear entirely normal, and

which we must experience in ourselves daily if we are to remain healthy.

If, therefore, a man occasionally becomes intoxicated, and if in this condition a more or less greater paralysis of the brain apparatuses serving the external psychic life takes place, which, by the way, is only temporary, it does not really mean a disturbance of these functions, but only a functional change of the apparatuses in question, which also takes place normally when sleep overtakes us.

The result is astonishing only for the first moment. If we examine it quietly, we soon see that it could not be any different. The only difficulty to be experienced would be in the fact that the substances producing our normal sleep can be permanently endured, while with artificial narcotics, as with alcohol, if it is used regularly, not for stimulation, but for stupefaction, a certain disadvantage is discernible in time. The result is that we do not advise anybody to stupefy himself incessantly with alcohol, and that we only maintain that an occasionally occurring alcoholic stupefaction is not dangerous, a fact proved anew in life every day.

On the other hand, the danger which is

brought on by the incessant stupefaction with alcohol in the habitual drunkard lies not so much in the frequency of the stupefaction, but in the fact that one must drink constantly increasing amounts of alcohol to produce stupefaction, that is, in the "habit." If the person who wishes to stupefy himself could always arrive at his result with the same quantity of alcohol, in the beginning not large, we should not know the type of the habitual drunkard at all. In reference to stupefaction, the brain can stand a great deal; many a man spends more than a third of his life in sleeping.

The salient point is the fact that, among all substances, our brain becomes the most slowly accustomed to those narcotics which we call normal fatigue products, while the soporiferous remedies must in time be used in always increasing doses (although with some their increase is very minimal); but, as has been stated before, the increase of the efficient amount of remedies which at the same time produce psychical excitation must be comparatively quick and strong if such remedies are to produce stupefaction repeatedly. Therefore the latter are the means least adapted to procuring stupefaction. The soporiferous

remedies are much better for that purpose. We possess to-day a considerable number of them which can be used for quite a prolonged period without a disadvantageous result. The reason for this is the circumstance that the acquisition of tolerance plays a part so much smaller that one can get along with a certain amount for a much longer period. And thus the difference between them and the normal fatigue products is only minimal, because also in the latter there is not entirely lacking a tendency for us to become accustomed to them, and because with them also it is in time dangerous to the brain if it becomes accustomed to too much of them.

We therefore see that it is the same with alcohol as with all other substances which we drink or eat. What is agreeable and useful to the sensible is dangerous to the injudicious. Applied to the circumstances under consideration, this means: The fact that the apparatuses of external psychic life become so easily accustomed to alcohol (that they will no longer be influenced in their function by a certain quantity) permits the sensible man to still indulge in his regular use of alcohol and to enjoy the stimulation produced by it; on the

other hand, it induces the drunkard, who drinks alcohol only to suspend these functions, to use constantly increasing doses.

We herewith conclude the chapter on the habitual drunkard. I believe the two points to which I have referred in the preceding really deserve full attention, as they permit us to draw certain conclusions from the drunkard to the sensible alcoholist.

We have not only seen that even in the drunkard the idea that alcohol produces only paralysing effects is not tenable, as the phenomena under consideration without doubt require immediately a psychic excitation produced directly by alcohol, but we here also look into the fundamental abyss which divides the brain of the toper from the brain of the sensible alcoholist. Ruined elements of the central nervous system are to be found only in the drunkard.

X

FINAL CONSIDERATIONS

Before I bring the description of the relation between alcohol and the central nervous system to an end, I wish to condense into three principal axioms the conclusions from the three special chapters (sensible use—isolated immoderation—habitual drunkenness) which are most important for practical life:

a. We cannot speak with positive certainty of the disturbances produced by alcohol in the nervous life so long as a man uses alcohol sensibly, so long as an isolated intoxication remains within limits, which here, too, are found in the sensible man himself.

This axiom is important for the reason that it induces us to confine the meaning of alcoholic poisoning within even closer limits than we have done in the beginning of our discussion on the central nervous system. We must restrict our statement which we made

there in so far as to concede that habitual drunkenness is always chronic alcohol poisoning, but we make a distinct question mark in the cases of so-called acute alcohol poisoning. With the first, such plain disturbances in the nervous life exist that our conception of poisoning is immediately acceptable, while with the latter we can only speak of disturbances, as we have seen, when somebody occasionally gets very drunk. In the ordinary cases of intoxication the expression "poisoning" is evidently too strong, and we are even right in saying that it is hardly possible to use it scientifically. In these latter cases the degree of "stupefaction" produced by alcohol remains within the limits of such functional changes of the organs of consciousness as appear also naturally in normal sleep; even the very moderate degree of stupefaction there existing usually does not by any means reach the degree which represents normal deep sleep. Besides, the stupefaction is not by any means the cause of the stage of being "jolly"; this cause is found only in the combination of inner psychic excitation with a slight dimness of consciousness.

Not regarding cases in which a man gets

very much intoxicated, the meaning of acute alcohol poisoning is very uncertain, and its application to him who is only jolly is absolutely challengeable.

There are only two positive cases of alcohol poisoning: 1, Dipsomania, 2, intoxication in its severer forms.

b. We must therefore distinguish absolutely between the sensible alcoholists and the habitual drunkards. Their reasons for using alcohol are entirely different; the first desires excitation, the latter more or less stupefaction. The course in both is entirely different; the first remains temperate all his life, while the second proceeds immediately to notoriously continuous excesses.

The effect upon the central nervous system is entirely different in the two. The sensible man does not show any disturbance or damage in the central nervous system, while the drunkard will surely ruin it in time.

The following points are of great importance for the public. It should, in discussing alcohol, always first decide: "Shall we speak of the drunkard or of the sensible alcoholist?" "Do these statements refer to the drunkard or to the sensible consumer of alcohol?"

One would then soon find that nearly all complaints against alcohol referred to the drunkard and not at all to the sensible user of alcohol.

c. Scientific critics can say absolutely nothing against the sensible use of alcohol, notwithstanding the existence of the habitual drunkard; they can only endorse the sensible use of alcohol.

For this third axiom, everything I have said in the medical part, as well as in the part pertaining to natural history, is nothing but an uninterrupted chain of proofs. I have nothing to add to it here, especially as I have before mentioned that the sensible man not only knows how much he can drink, but also when he can and when he cannot drink alcohol.

We have now more or less finished what is called the science of alcohol. We know the position of alcohol to living nature, its fate in the organism, its use as a nutrient, and its influence upon the organs, all this according to the present condition of science and of importance especially as regards the sensible use of alcohol.

In this whole field there is not one fact

(compare the axiom of this conclusion) which could make one averse to the moderate use of good alcoholic beverages, but there are many facts which show it to be not only agreeable, but useful, even necessary, in many conditions of life.

This result is really not surprising; I do not think that science can change it in the future except with regard to unimportant details. What has been described is hardly anything more than verification of what the experience of many centuries in all its principles has laid down. It is an explanation of facts acquired by experience, and to overthrow these would mean an error of reasoning.

The experience in alcohol existed, and science had to come to terms with it (not *vice versa*, not experience with science), had to explain it. This seems to have been somewhat forgotten at times, but science has tried for years to vindicate alcohol from the injustice committed against it. The coming years will show this much clearer.

We shall conclude our discussion by explaining a few questions which have been mentioned, and which I also must mention, and

with a summing up of our knowledge of the "poisonous nature" of alcohol.

The questions mentioned are: The generative ability of the human race, the ability of women to nurse their new-born babies, and the relationship between duration of life and the use of alcohol. In all these three points it is, again, of the greatest importance to distinguish absolutely between the drunkard and the sensible alcoholist, so as to have a clear result.

We shall first speak of the habitual drunkard. It is an old human experience that the drunkard, if he is really still able while a drunkard to become a father, will then, and only then, often have sickly children. To endorse this experience we need neither medicine nor natural history. Everybody has taken it as only natural that a more or less ruined organism cannot produce something perfect.

Furthermore, I do not think that anybody is astonished to find that a girl conceived during the drunkenness of her father, participates in the inheritance of his debilitated faculties and is as a mature person a weak woman—if she, by the way, ever reaches that age, as nature in such cases usually prevents it—who

if she ever bears children cannot nurse them herself.

Finally, we really expect, I think, that habitual drunkards will not on the average live so long as they would have lived had they not drunk habitually. So far there is nothing to be explained, as there is a clear understanding in the public's mind. This will change entirely if we leave the habitual drunkard alone and turn to the much more important men who use alcohol sensibly although regularly. In these cases there does not exist a pernicious influence of alcohol, in reference either to the capability of procreation, or to the ability of women to nurse their babies, or to the duration of life.

Here, again, detailed scientific demonstrations are unnecessary, an experience has long since proved over and over the correctness of the theses stated. The German empire, which has grown in thirty years from about forty to sixty millions of people, proves that nations can very well increase notwithstanding the use of alcohol.

Furthermore, the institution of wet nurses proves that daughters of men who use alcohol more or less sensibly are very well able later,

as mothers, to nurse babies. Everybody can convince himself daily that in countries where it is the usual custom to engage wet nurses women descended from parents who are anything but abstinent from alcohol come into the city to nurse the children of ladies who indulge in coffee and tea. Or does anybody really think that the fathers of wet nurses are abstainers from alcohol? He should go to the village fair in the vicinities in question to get the right idea.

Finally, experience teaches us that a sensible use of alcohol does not shorten life. Besides, it has twice been demonstrated in Germany [35]. The mode of living of the oldest inhabitants among a great number of people has been twice examined, once, for example, that of the oldest people among 400,000 inhabitants of large cities. Both times there were found among the oldest men not only sensible alcoholists, but men who were accustomed to heavy drinking and men who had all their lives committed alcoholic excesses. And this, notwithstanding the fact that the examinations were carried out among the inhabitants of different parts of Germany, that the examinations lay many years apart, that

both examiners, independently of each other, were really convinced that something detrimental to alcohol would be found. Both results could absolutely not be used against alcohol.

He who expects to live especially long because he abstains from alcohol may experience a bitter disappointment.

We have now answered the questions, and we once more recapitulate our opinion about the so-called poisonous nature of alcohol. We have already paid some attention to this during the discussion of the influence of alcohol upon the central nervous system.

I have previously stated that we can understand it clearly only if we do not allow the word "poison" to make an impression upon us. "Poison" is, under the circumstances, of an extraordinary relative signification.

I discriminate between two meanings in the word "poison." The one is the sense in which it is used in practical life, and the other is the sense in which the word is sometimes used in science.

It is now entirely self-evident that alcohol in the sense of practical life does not belong to the poisons, because, if it were a poison, it

should satisfy the requirement of producing a certain disturbance of health in a certain small quantity.

What, therefore, should brand alcohol as a poison? That when used in an overabundance (I repeat something stated before) it injures? That certainly not, as that is the case with all nutrients. That there exist so many drunkards, people who injure themselves by permanent alcoholic excesses? Certainly not that either, as there are many more people who injure themselves by excesses in eating. That it must be forbidden to men in certain diseases? Certainly not that either, for, if we cannot entirely interdict albumin and carbohydrates for rheumatics and diabetics on physiological grounds, I might say unfortunately it would certainly be best for these people if we could do so. We, therefore, must be satisfied to curtail as much as possible the nutrients, albumin and carbohydrates, for these patients. Nobody classifies them on that account as poisons any more than asparagus and celery are to be looked upon as poisonous plants because the patient with kidney disease has to avoid them.

" Excess " in the use of alcohol certainly ap-

pears earlier than that in the use of albumin, but that is not a fundamental difference, but one of degree only. It is not even a very important one, as I shall explain by an example in figures: Munich beer, not brewed for exportation, contains about 3½ per cent. of its weight of absolute alcohol (that is, chemically pure alcohol), or in 1½ litre of beer about 53 grammes of absolute alcohol. Now, has a citizen of Munich ever become sick because he drank every day 1½ litre, that is, 53 grammes of absolute alcohol? It would be very hard to demonstrate that. If we double the figure 53, we get 106. Now, 106 grammes of chemically pure albumin, contained in 670 grammes, or 1 1-3 pound of beef, are as a daily amount nearly the quantity of albumin which in the long run a man who performs no hard work may not transgress; the high mark would be about 120 grammes.

If we now place against 120 grammes of chemically pure albumin taken daily only 50 or even 35 grammes of alcohol (1 litre of beer daily) there will be a difference, but it will never be the difference between a nutrient and a poison.

What has so far been said refers only to a

man who does not perform very hard labour, and I have surely figured the amount of albumin rather too high than too low. If we now proceed to a man who is forced daily to perform very hard muscular labour, the proportion will be changed much more in favour of alcohol.

I cannot believe that 3 litres of beer daily would hurt a man from Upper Bavaria who performed very hard muscular labour; that is very improbable, and it must first be demonstrated in practical life before one would accept the statement. That would be 105 grammes of absolute alcohol in a day. If we double 105 we get 210 grammes. Would a specialist advise a man performing hard muscular labour to use continually 210 grammes of albumin daily (contained in 1,300 grammes or 2 3-5 pounds, of beef)?

I think he would have his doubts! And if one placed in opposition to 105 grammes of alcohol (3 litres of beer), consumed permanently every day by a man who performed hard muscular labour in the open air, 250 grammes of pure albumin (3 pounds of beef), if it could be absorbed—no specialist would permit it,—250 grammes of albumin would be

equivalent to 105 grammes of alcohol. This would be a difference, but never the difference between a poison and a nutrient, but only a difference between two nutrients.

I most emphatically advise the reader to think carefully over these examples in figures. They will teach him more clearly than all words and sentences that it is impossible to class alcohol among the poisons.

We have thus settled the practical side of the question. Now, how about the scientific position of alcohol? We shall define this also, a thing which, so far as I know, nobody has as yet attempted to do. Alcohol has up to the present time been classed as a nerve poison. But, as it has shown itself to be a nutrient, the name of nerve poison given to it cannot be accepted any longer, for it does not correspond to the properties of alcohol. We must therefore again ask: Where does alcohol belong?

The answer is not so easily given. It is not possible to classify nature strictly without leaving a remnant somewhere, but I think we can reach a conclusion in the following way:

We will place all nutrients upon one side and all poisons upon the other. We then

ask ourselves from which of the two groups is alcohol separated by a fundamental gap, and from which one not. The question, thus put, permits of only one answer, which reads: Alcohol is separated from the poisons by an unbridgeable gap, as not one of the poisons nourishes.

On the other hand, alcohol is not separated from the nutrients by such an unbridgeable gap, as its second property, not only of nourishing, but also of influencing the functions of certain organs, is found in principle in the true nutrients, the carbohydrates. These also, as we have seen before, influence the organs (the heart, the vessels, perhaps the central nervous system) in a special manner [36]. Alcohol therefore belongs essentially to the nutrients and not to the poisons.

Note: It may not be superfluous, in regard to the general public, to refer here to the fundamental difference which exists between alcohol and poisons which produce fatty degeneration. Phosphorous and arsenic, being true poisons, naturally do not nourish. They produce fatty degeneration of the organs, and thus only originates the fat found in cases of poisoning with them. The organs are here dissolved into fat. Alcohol, on the other hand, like every nutrient, produces a fatty deposit in the organs. When overfeeding takes place, the fat in

these cases comes therefore from the nourishment absorbed.

Finally, where the organs are destroyed by reason of the continued and immoderate use of alcohol, this is, in the habitual drunkard, we do not find fatty degeneration, but chronic inflammations and a shrinking which is not influenced by the appearance of a few small drops of fat. The drunkard has, as is well known, a shrunken liver (that is, if he really has liver disease), but not a fatty liver, as is found in those poisoned by phosphorous.

I really think that the difference existing here between alcohol on the one hand and phosphorus and arsenic on the other hand is so clear that even a layman can understand it immediately.

Naturally, alcohol now has a separate position among the nutrients because it exerts, besides the nutrient effect, specific effects upon the organs, especially the nervous system, which are much stronger than the specific effects of the carbohydrates. That makes no difference in reference to the fundamental position of alcohol to which we must refer it. And this so much the less, as we have seen that the specific effects of alcohol are again not disturbances, not poisonous effects, but simply functional changes which remain here within otherwise normal bounds, as long as man is sensible in its use, even if occasionally intoxicated.

We therefore have here a substance which, if used sensibly, nourishes and, besides, exercises specific influences especially upon the nervous system, but such specific influences as effect changes in the nervous system which correspond to changes in the normal action, and do not represent disturbances, that is, phenomena of poisoning.

Such a substance does not scientifically belong to the poisons, but to the nutrients, especially to the class of nutrients which also possess specific effects; the most pronounced representative of these is alcohol, while the least pronounced, so far, are the carbohydrates (starch, sugar).

Alcohol is therefore not a "poison," but a "nutrient" and "luxury."

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It would be impossible to enumerate singly all the special essays referring to our question. That would not only change the entire character of our treatise, but would unnecessarily enlarge it. The judicious reader will have noticed that this is an entirely original essay, for which the critical collection of the raw material in question possesses only the rank of an introduction. Furthermore, the general public, for which this book is especially meant, would not derive any profit from further references. Lately authors have confined the literary references in their text-books to those absolutely necessary; very often they omit them entirely. I confine myself therefore in this respect to the following directions: That not everybody who has once upon a time written about alcohol imagines that every following author must have read his book. I wish to emphasise the fact that the specialist is more or less interested only in works which contain facts and possess scientific value. The specialist is expert enough to form the right impression, idea, or theory. This raw material is contained in the special original essays and notices, which only therefore have been of interest for me.

I wish to add to this a few remarks of interest only for the specialists. Although my book is meant for the general public, I must certainly be prepared to have the specialists read it. For the benefit of these men, I wish to complete the bibliography with the following.

First, I have limited myself in my citations to publications of the years 1892–'93 to 1904–'05, as

the older literature is contained in the handbooks and text-books treating of the subject.

Notwithstanding this, the international material compiled during this time is quite large, about 120 original publications. I have had to refer, not only to the investigations about the effects of alcohol, but also about glycolysis, the metabolism of carbohydrates in the organism, the modern alcoholic fermentation without living yeast cells, etc. It is impossible, as has been said, to enumerate all these and still to adhere to the limited space of this work. I shall in the following mention the names of the authors from the years 1892–'93 to 1904–'05 whose investigations became known to me while I was compiling my book. I do this that an author of whom I have not made use may call my attention to the fact, furthermore, that an author whose investigation did not correspond to my reports may know that it was not on account of ignorance on my part that I did not mention him, but because his work had been superseded by later reports or because it could not alter my deductions.

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Brunton, Lee, Lépine, Locke, Manassein, Martz, Mayer, Mazé, Meinert, Meisenheimer, v. Mering, Mendel, Mertens, de Meyer, Molinier, Neumann, Nicloux, Ott, Passy, Pekelharing, Polzeniuss, Portier, Rapp, Rhodes, Rosemann, Rosenbaum, Rüdin, Salant, Scheffer, Schnyder, Schumburg, Singer, Simacek, Stepanek, Sternberg, Stocklasa, Stolle, Swientochowski, Tibald, Vas, Vitek, Fr. Voit, v. Wendt, Wilmans, Wroblewski.

With this report, I think, I have materially assisted the scientific critic and have still adhered in this literary note to the original form of my work.

I certainly take it for granted that the scientific critic is acquainted with the theories and hypotheses of our subject which have appeared within the last fifteen years in the text-books.

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